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CONTENTS.

EDITORIAL:
- Publisher's Announcement 669
- The Election 669
- Can We Use a New Combustible? 670
- A Difficult Phase of Power Solicitation 671
- The Pennsylvania Electrification 671

American Electrochemical Society 672
Electrical Ordinance for Atlanta, Ga 676
Brooklyn Modern Science Club 676
Use of Electric Power for Safety in Mines 676
Electric Power in the Collieries of South Wales, by A. H. Bridge 677
Telephone Company Demands Portion of Telegraph Tolls 681
Financial Reports of Electrical Companies 681
Two-Motor-Drive Web Printing Press, Manual Control, by S. H. Sharpsteen 682
Water-Power Development at Great Falls, Mont 684
Engineers' Society of Milwaukee 684
Frederick A. C. Perrine, by Ray D. Lillibridge 685
Pennsylvania Terminal Electrification Contract Let to Westinghouse Company 685
Alternating Currents and Their Applications, by Edson R. Wolcott 686
Electricity Direct from Coal 687
Probable Earnings of the Hudson Tunnels 687
Illinois State Electric Association 688
Central Electric Railway Association 690
Handling of Live Wires and Fire Streams 690
International Conference on Electrical Units and Standards 691
Construction of Selenium Cells 692
Changes in the Western Electric Company 692
Recent Sources of Electric Light 693
The Alternating-Current Railway Motors of the Oerlikon Company and Their Effects on Telephone Circuits 693

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE 694

Civil Service Examination for Electrical Engineers and Draftsmen—Office of Supervising Architect 695
Report of Earnings of the Northern Ohio Traction and Light Company 695

INDUSTRIAL SECTION:
- Some New Benjamin Specialties 696
- Curve-Drawing Instruments for Alternating and Direct-Current Circuits 696
- Feed-in and Strain Support for Feeder Cables 697
- Electric-Motor Friction Brakes 698
- A New Flashing Socket—the "Firefly" 698
- Schureman Alternating-Current Elevator Controllers 699
- Electrodeposition of Brass 700
- Remarkable Performance of Allis-Chalmers Steam Turbine 700
- Silico-Vanadium Transformer Steel, by H. W. Young 702

Texas Independent Telephone Convention 702
CURRENT ELECTRICAL NEWS 703
RECORD OF ELECTRICAL PATENTS 712

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PUBLISHER'S ANNOUNCEMENT.

With the present issue the ELECTRICAL REVIEW, of New York, and the WESTERN ELECTRICIAN, of Chicago, join forces, and make their bow as the "ELECTRICAL REVIEW AND WESTERN ELECTRICIAN." The success with which both these journals have been conducted in the past is an assurance that the combination of forces will create a great national electrical weekly of influence and value to readers and advertisers alike. The ELECTRICAL REVIEW is the product of twenty-seven years' service in the development of all that is best in the electrical industry. The WESTERN ELECTRICIAN was founded in Chicago twenty-two years ago, maintaining a prominent position as a thoroughly representative journal, receiving the support of the entire western electrical fraternity.

In consolidating these two publications the editorial and business organizations of both have been continued and merged, and the western and eastern offices have the support of strong editorial and business departments. Those characteristics which have made each journal distinctive, and which have been rewarded with loyal support, will be preserved, and a constant effort made to improve the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN along every line which good judgment and the necessity of the electrical reading public may dictate. This journal will continue to be of interest and value to the technical man with its contributions and editorials concerning highly specialized fields of research and operation; and along those lines which interest the practical man and indicate the best methods of conducting public service utilities of the smaller size, the paper will be strengthened in every direction.

THE ELECTION.

On November 3 the voting citizens of the United States cast their ballots and elected to office for the conduct of the national administration the candidates of the Republican party. So considerable was the majority that it would appear that the question, shall the people rule, has been definitely settled nationally for the next four years at least. The policies of the present administration have been endorsed, and the at-

titude of all good citizens should now be to support the incoming administration without respect to partisanship. The constant betterment in industrial circles which has been going on for the past three or four months has been an indication of the growing confidence of investors in general in the stability of the institutions in which their fortunes were involved. It remains now for a healthy continuation and stimulation of this confidence to bring about a new era of prosperity, and a golden opportunity for all men to make the best of life and liberty and the pursuit of happiness.

Statewise it appears that in those commonwealths where public service commissions have been inaugurated through legislative action, and where a change in administration might have jeopardized the continuation of these commissions, that the will of the people has spoken for their continuance. Already there has been a concession of admiration on the part of public utility corporations for the sanity and benevolence of properly governed and practically restricted regulating commissions, the companies realizing that no commission can effect the confiscation of a real investment so long as the courts are open to the public and the public service corporation alike. The old bugaboo of municipal ownership seems not to have been raised at all in the recent campaign, and it can be stated with little prospect of controversion that municipal ownership has died a peaceful death, and that its demise has been due to the turning on of the light of intelligent publicity by the public service corporations in the largest cities in the country, particularly those where public service commissions have been instituted.

In Illinois the International Improvement Commission issued a circular asking votes in favor of a proposed $20,000,000 bond issue to be used in constructing a waterway from Lockport to Utica, Ill. This will provide an important link in the deep waterway from the lakes to the gulf. The matter came up before the voters as an amendment to the constitution permitting the bond issue. The present drainage canal extends twenty-nine miles from the south branch of the Chicago River, in Chicago, to the city of Lockport, where it connects with the Desplaines River. There is a further extension of one and three-quarters miles to the powerhouse between Lockport and Joliet, where there are at present three 4,000-kilowatt generators, a fourth being in process of erection, and where four more are to be installed as the power demands require. Under the plans of the International Improvement Commission four power plants are to be erected, with a gross estimated development of 140,000 horsepower. The returns from the ballots on election day showed a tremendous majority in favor of the issuance of the bonds. Not only is the state of Illinois interested in this development, but the entire West has congratulated itself upon the active interest which the voters of Illinois have taken in this issue, because it required not only a majority of the votes cast to be in favor of the bonds, but every vote that was not cast for or against it counted against the issue.

The great publicity which has recently been given to the conservation of our waterpower resources, to the canalization of our barely navigable rivers, and the necessity of the development of our inland waterways and our cheaper sources of power going hand in hand, has directed the attention of all thinking men to this problem, and it is only through this publicity, which has been secured through the open-minded and forceful co-operation of the press of the country, that the result announced herewith has been possible.

CAN WE USE A NEW COMBUSTIBLE?

For years the dream of inventors has been the production of power by some direct means of breaking down the chemical associations which render inefficient, to a high degree, so many of our present-day methods of utilizing the potential energy of our known combustibles. Great effort upon the part of assiduous workers, and the expenditure of large amounts of money, have resulted time after time in apparent failure, and today it would not appear that we are not much nearer the solution of this problem than we were several decades ago. Within the last few years there has not been chronicled much in the way of development in this direction, so that the suggestions made by Mr. Edward C. Warren, in the current issue of *The Engineering Magazine,* in an article entitled "Fuel for Power Generation," should excite considerable interest.

Mr. Warren delivers himself of the postulate that "power costs nothing." By this he means that we should secure our means for the provision of energy, not by any elaborate process of combustion, which apparently wastes the material involved, but we should use our combustibles under much the same conditions as we utilize the power of the waterfall; that is, by simply taking as a natural thing the energy-producing condition, and being obliged to expend money only for the harnessing of the natural element.

It is ingeniously pointed out that Nature, in bringing back to the watershed in the form of rain and dewy precipitation the source of power which has already caused the mill to grind and the water turbine to turn, points the way to the short-circuiting of the ordinary cycle of the utilization of our known combustibles. Carbon and hydrocarbons, our most popular forms of fuel at the present day, in combination with oxygen, form a combustible material. After the generation of heat the atom of carbon unites with its two atoms of oxygen, and ages are necessary to bring about the reorganization of these elements, through the evolution of plant life, so that the matter which is being used up today will not be available again for the present generation.

Why not use hydrocarbon for fuel? This is the leading question in Mr. Warren's communication. Its symbol is H, its chemical equivalent is 1, its heating value in combustion with oxygen is 60,000 British Thermal Units per pound. What are the special qualifications of hydrogen as a fuel? Its heating value per pound is four times that of the best coal. But where are the natural deposits or supplies of hydrogen? All of the foregoing belongs to Mr. Warren. He is of the opinion that the supply is inexhaustible, and that its natural cycle through the processes of isolation, combustion and re-isolation is so short

as to render feasible a continuous re-use of the same volume of fuel substance. It has the practicability of perfect combustion, without ash, smoke or soot, without vitiating gases; for the sole product of combustion is water. The combustion being perfect, the product of combustion is aqueous vapor, immediately condensable and susceptible of ready decomposition, and yielding ready to hand, not merely the original volume of hydrogen, but the oxygen requisite for its immediate recombustion. With this statement the author concludes that we shall derive our supply of both hydrogen and oxygen from the waters of the earth, and that we shall simply insert or interpose our mechanisms or harness in a natural fuel cycle, and derive unlimited supplies of power by intelligently short-circuiting a naturally simple and expeditious cycle of one of Nature's elements.

So far so good. The elucidation of a practicable and commercial means of isolating the constituent elements of our projected combustible is left for another time and place. The matter is worthy of investigation. Possibly there are flaws in the author's reasoning. If so, we shall be sure to hear of them in the near future. He says that the power user has never asked the chemist whether this were possible, and that because someone long ago instituted the use of certain forms of combustibles, and let it go at that, that we have been content to plod along the lines laid out for us and utilize in wasteful fashion that which in the nature of things must some day be materially exhausted. The subject is of great interest, and the fuel problem of the future is pregnant with the possibility of development. Mr. Warren's further ideas on the subject will be watched for and welcomed.

A DIFFICULT PHASE OF POWER SOLICITATION.

In most large communities where the central-station power business has shown a gratifying growth in the past few years there exist a number of private plants which for one reason or another are extremely hard to convert to the operating company's service. The chances are that each of these isolated installations has been approached at least three or four times by representatives of the central station, with the apparent net result of making little or no progress. When a rival interest like a local gas company is hard at work to keep out the electric motor, the problem of securing this business is rendered doubly difficult. To give up the attempt to secure the business, however, is poor policy, and the central station should never erase the name of an isolated plant from its list of prospects. Sometimes it may be a year or two before any chance occurs to introduce the subject of power purchase to the isolated-plant owner, but the probabilities are that if the conditions are watched with keen attention, some day there will be an opportunity to install at least a small motor-connected load as an entering wedge. Unless the plant is operated with more than ordinary skill it is almost certain to fail to give continuous service at some critical period, and even if there are no interruptions, it is probable that the total operating costs, if rigorously set down, would surprise the owner, especially where new types of equipment are in service.

Close observation of the growth of the isolated-plant-owner's business, the need of fresh space in his store or factory, occurrence of accidents, probable excessive cost for repairs, troubles with labor in the engine or fire room, complaints of other parties regarding noise, smoke or dirt, with the possibility of interesting him in new designs of motors or lamps specially adapted to his conditions, should all be kept in mind. The acceptance of some famous rush order for a manufactured product may require more power to prevent severe overloading of the existing apparatus. Or again, the motor drive may permit the rearrangement of machinery in such a fashion that the efficiency of production will be increased many per cent. Conditions alter in the isolated plant, as in every other commercial agency, and by never ceasing to watch for a turning point in affairs it is probable that the central-station man will in time have some chance to show what he can do.

In some cases where the power rates offered by a central station are lower than those of a rival gas company, the owner has been known to advance the argument, that by installing tungsten lamps he can reduce his output enough to give a good margin for future power requirements. The effect of so reducing the load on a gas-engine equipment of low power is at once apparent to an electrical engineer, but it needs to be emphasized in a way that the private-plant owner will not fail to appreciate. Any notable reduction in load on a small prime mover means a serious loss in economy, which can often be figured pretty closely in terms of dollars and cents. When a local gas company is obliged to pay the cost of installing a gas-engine equipment in an isolated plant, the price being gradually paid back by the owner on installments along with his monthly bills, it is clear that electricity is pushing matters close to the wall. In order to gain a good customer of this sort there would seem to be no reason why the central station could not adopt the same plan with regard to motor installations in exceptionally hard locations. It will pay to emphasize to the owner facing such a proposition from a gas company that by the time the gas engines are paid for the depreciation is certain to have rendered them worth but a small percentage of their original cost, unless the most expert skill is available for the care of these small units.

THE PENNSYLVANIA ELECTRIFICATION.

From time to time announcement has been made that various commissions had under way the study of plans for the electrification of the terminal zone of the Pennsylvania Railroad. The great expansion of the local service of this transcontinental system by reason of its tubes under the Hudson River, Manhattan island, the East River, and in Long Island, in connection with the Long Island Railroad, has made imperatively necessary the utilization of electricity as a means of propulsion. It is with satisfaction therefore that we read the announcement that an appropriation of $5,000,000 has been made to begin the work of electrification, and that a contract has been let to a large manufacturing company to lay down the initial electrical equipment.

American Electrochemical Society.

Fourteenth General Meeting, New York, October 30-31.

The fourteenth general meeting of the American Electrochemical Society was held in the city of New York on Friday and Saturday, October 30 and 31, 1908. The session of Friday was held in the chemistry building of the College of the City of New York.

President Edward G. Acheson of Niagara Falls, N. Y., called the meeting to order on Friday morning at 9:40 o'clock.

The first paper considered was "The Use of a Mercury Cathode in the Determination of Metals," by A. Harold Porter and Francis C. Frary. The conclusions reached in this paper are:

1. The electrolytic determination of zinc in a mercury cathode gives low results, due to loss of both zinc and mercury in the process of washing with alcohol and ether.

2. Pure mercury does not lose weight appreciably when washed with water, alcohol and ether, nor by liberation of hydrogen on its surface even at high temperatures (100 degrees).

3. The loss in weight during washing seems to be peculiar to zinc, since copper amalgam shows no signs of it, and the determination of copper by means of mercury cathode is quite satisfactory.

The discussion was opened by Dr. H. E. Patten, who requested that the exact voltage, current and current density used in these determinations be given in the final report on the subject.

Walter T. Taggert then discussed the subject at length, giving details of the methods he had successfully used and precautions that must be observed to get reliable results.

Prof. J. W. Richards also spoke critically about the paper.

The second paper, entitled "The Passivity of Nickel and Iron," by Dr. E. P. Schoch, was read by Dr. Patten. The author was led into his study of these phenomena while working on the potential of the reversible electrode. The paper was briefly discussed by W. D. Bancroft and Dr. Patten.

A paper on "Chemical Energy," by J. E. Mills, was then presented. In this paper the author seeks to ascertain the ultimate origin of energy liberated in a reaction and show its amount varies under different conditions. The argument is based on the reaction occurring when the gases hydrogen and oxygen combine to form water. Among the conclusions reached is one that the attractive forces, whatever their nature, whether chemical, molecular, magnetic, electrical or gravitational, which proceed from a particle are definite in amount. If this attraction is exerted upon another particle the amount of the attraction remaining to be exerted upon other particles is diminished by an exactly equivalent amount. The relationship between chemical and electrical forces is considered in its bearing on the conductivity of substances. This paper was briefly discussed by E. Durant and L. F. Guttman.

Prof. Charles Baskerville, director of the laboratory of the College of the City of New York and chairman of the local committee that had arranged for the meeting, then presented President John H. Finley of the College of the City of New York.

President Finley welcomed the society in a pleasant speech, in which he grew reminiscent of the chemical and general scientific training he had received in his early college days and contrasted it with the advances that had been made in the teaching of science at the present time.

G. A. Hulett then presented his paper on "Equilibra in Standard Cells." It was discussed at length by Dr. W. D. Bancroft, who argued that the basic salt cannot coexist with mercury sulphate except at one concentration of the sulphuric acid.

A paper was then read by G. W. Morden on "The Formation of Nitric Acid from Air by Means of Low-voltage Direct Current." The discussion was participated in by A. L. Cushman, F. A. Lidbury, L. F. Guttman and the author. It related mostly to the influence of the portions of the arc, from which the gases were removed, upon the composition of the gas. As the arcs were only from three to six millimeters in length, with four millimeters average, conclusive results on this point were not obtained.

FRIDAY AFTERNOON SESSION.

At the afternoon session the first subject considered was introduced in an informal address by Prof. A. F. Ganz on "The Corrosion of Underground Structures." He said the corrosion of underground metal surfaces may be divided into two general classes, first, corrosion due to purely chemical causes or ordinary rust; second, corrosion due to electrolysis from stray electric currents. Whether or not all chemical corrosion is also electrolytic in its nature does not alter this decision from the standpoint of the practical engineer.

When an electrical engineer is called upon to make an electrolytic investigation of, say, a pipe system, he may have two distinctly separate problems to solve. The first problem is to determine the electrical conditions of the metal system, that is, the potential at various parts of the system with reference to the surrounding ground, and with reference to other underground metal. He must determine the current flowing, and if possible the point where the currents leave the structure for the ground, because these are the points where corrosion may develop. If in this investigation he finds that the system is in electrolytic danger, then his second problem is to recommend some method whereby the danger can be substantially removed and at a reasonable cost, which is always an important element.

Attention was called to a wholly incorrect method which has been used in this country, and has been published in a certain class of electrolysis reports, in which the potential differences are measured between pipe and rail, and the earth resistance is measured at the same points, or to be more correct, the resistance is measured between the pipe and rail, which is called the earth resistance between these two points. This resistance is then divided into potential difference, and the current so found is stated to be the current flowing between these points. This is repeated, every block for a given system, and the currents are added up, and the total current so found is stated in all seriousness to be the current which flows in that street between the pipe and rail. The absurdity of that method should be clear to all, and every member of the society was asked to take every opportunity to show up in every possible way such fallacious methods, because they have done a great deal of harm.

The question has often been asked whether the steel foundations for bridges and buildings which are usually imbedded in concrete are also suffering from corrosion, due to these stray railway currents. These metallic underground structures do not have the same opportunity of picking up currents from any extended area. There is one case, however, where such structures may be in serious danger. If a pipe comes in contact with such a structure mechanically, as is sometimes the case, and the pipe is carrying current, it is positive to the surrounding ground. Under these circumstances a current picked up over an extended negative piping area may be delivered to the metallic underground structure and, leaving it, produce corresponding electrolytic corrosion. In a number of instances special precautions have been taken to insulate the steel foundations of structures from piping systems, and it seems to be a safe precaution to take in all cases.

Where dangerous conditions in an underground system are found, the second problem that the electrical engineer has to meet is to recommend proper preventive measures which will not be prohibitive in cost. It is there that the electrical engineer can get the most help from the electrochemist. If the underground metal system is continuous it may be connected to the negative return system of the electric railroad. That is, however, a matter which invariably greatly increases the current flow on the pipes and produces other dangers. For instance, at a high resistance

point, which may develop in the joint, the current may shunt around such a point and produce corrosion. The greater danger, however, lies in the danger that such a bonded system is to all other underground metal systems. If one connect one piping system to the negative bus-bar, one renders it highly negative to all other underground metallic structures and introduces current flow to this pipe system, and thereby this system becomes a part of the railway return circuit and a party to any damage that may be done.

Professor Ganz then submitted five questions which embodied the points that he wished to open up for general discussion. The first related to the activity or passivity of iron in street soils. As Professor Harber of Karlsruhe, who is investigating this question pretty thoroughly, concludes that under the ordinary soil conditions iron is always in the active state, that practically the passive state does not exist in underground metal systems, the question was raised what can be done to render active iron passive. Some one had suggested to cover an underground pipe with lime for that purpose. Question No. 2 referred to means for identifying the causes which have produced a given corrosion. As a practical example of this, Professor Ganz showed a number of lead cable and pipe samples that had been submitted to him to find out whether they were pitted by electrolysis. Question No. 3 was, "Can we protect an underground metal structure, such as a piping system, by coating it with an insulating material in such a way as to prevent current entering or leaving that pipe?" Question No. 4 related to the breaking up of the continuity of underground metallic structures, as, for instance, by the use of insulating joints, the point being whether this method can make such a pipe system substantially safe from electrolytic corrosion. The last question was, "What is a safe current density per square foot of pipe surface for current leaving for ground?"

Dr. Allerton L. Cushman called attention to corrosion of plates of steamships and of pipe lines remote from electric circuits that was as destructive and of the same nature as that known to be due to electrolysis by railway return currents, and argued that this corrosion is due to electrolytic action whether an extraneous current is present or not.

Maximilian Toch corroborated what Dr. Cushman said with reference to the corrosion of these pipes and plates. He said it is settled in his mind that all corrosion is an electrolytic function. That is the fundamental basis of it. He believes that stray electric currents aggravate this corrosion. With reference to coating gas pipes with asphaltum, it was found by a natural gas company that built a pipe line from Peoria to Chicago and coated it with asphalt about a quarter of an inch on the inside and half an inch on the outside, that since fuel gas is a powerful solvent for all bituminous compounds, in a very short time the entire pipe was so clogged up with the dissolving bitumen and bituminous compounds that it became useless, so that bitumen or asphalt or tar should be excluded from the interior of a gas pipe.

Professor Ganz said the distinction he made in his remarks was not a distinction between chemical corrosion and electrolytic corrosion, but a distinction between corrosion produced without outside electric currents and corrosion produced with outside electric currents, which is an engineering problem. He knew of some private corporations owning very considerable underground pipe systems—one in particular where a single pitting in a pipe caused a damage of $50,000 indirectly, and these companies will gladly spend any reasonable amount of money if a method can be devised for permanently protecting such important pipes. He did not propose this method for the distributing system for water or gas in any city where the whole system would have to be treated, but there are many cases of importance, such as high-pressure lines, where generally any reasonable expense will be gladly paid if permanent protection can be assured.

Carl Hering believed that current cannot leave the pipe for the soil, that is, if there are liquids in the soil, without causing corrosion. There is one method by which a pipe might possibly be protected. If there is a pipe from which it is known that current is going to flow out, by attaching to the pipe metallically a block of zinc buried in the ground, any current which is bound to go into the ground would prefer to leave through the zinc than through the pipe, because it takes less voltage, and as long as the zinc is there and is not destroyed the pipe would be protected, the zinc being replaced after it is consumed. As to coating pipes to prevent corrosion, while this may prevent it, where it keeps the electrolyte from coming in contact with the pipe, such coatings are very apt to be injured in spots, which means that the corrosion instead of being spread over a large surface will be condensed into a small surface, and will therefore do all the more damage, because if the current is condensed on a small area it will eat through the pipe in shorter time. What current density is a safe limit should be answered by saying definitely none. That is, no current density leaving the pipe is safe, because one never knows whether it is going to leave from that area or to be confined to a quarter of a square inch. In a number of cases, when a pipe was in danger at a certain place and was protected there, it was thought that that was sufficient. To Mr. Hering this seems very incorrect reasoning, as it simply shifts the danger point to another place.

R. H. Gaines cited a case of a pipe line near the city of Rochester, where all the elements of corrosion showed that it was simply due to stray currents, yet no potential difference could be found with the millivoltmeter between the pipe and the ground, and there was known to be no source of commercial electricity anywhere in the neighborhood.

The discussion of Professor Ganz's subject was concluded by I. L. Roberts, W. D. Bancroft and S. S. Sadtler.

A paper on "Correct Methods of Measuring Stray Currents," by Dr. Clayton H. Sharp, of the Electrical Testing Laboratories, New York city, that was on the programme for Saturday morning, was then taken up. Dr. Sharp had no written paper and presented his views on the subject verbally. The chief point to be found out is whether there is at any point any considerable amount of electric current leaving the pipes. The problem is easily stated, but it is not so easily answered, for the reason that in general it is not possible to destroy the continuity of the system of piping in order to insert instruments, and it is not possible to insert instruments in the surrounding soil without disturbing the conditions as they actually exist in practice.

The electrical instrument which is used chiefly in investigations of this nature is the voltmeter or the millivoltmeter, and this instrument has sometimes been used with very distressing and alarming results. However, one can gain a great deal of information by the proper use of the voltmeter. One may feel quite sure that where the trolley line and other structures are positive in potential with respect to the pipe, the pipe is quite safe. Also, that where the pipe is positive to other structures, that it may be in danger. It is wrong to conclude that, because it is so, that it is actually in danger—for instance, it may be quite well insulated by passing, say, to dry sand or gravel from moisture, so that the discharge of electricity from the pipe to the soil electrolytically is prevented.

Having determined by the use of the voltmeter what the possible danger areas are on a system of piping, the next step is to determine the current flowing on the pipe, and especially the current leaving the pipe. To determine this the most satisfactory method would be to interrupt the electrical continuity of the pipe by inserting an insulating joint, and then spanning that joint with wires passing through an ammeter and measuring directly. This, however, is often not feasible. Consequently, it is necessary to revert to indirect methods for measuring the current. The principal one is by means of the fall of potential on the pipe. Electrical connections are made at two points on a single length of pipe to a sensitive low-reading voltmeter, preferably one of high internal resistance, and the indications of this voltmeter or millivoltmeter are read over a sufficient period of time to show what the average condition of the pipe is. Then, if the resistance per unit length of pipe is known, it is possible to interpret these millivolt readings in terms of amperes of current flowing on the pipe. The difficulty with this method is the determination of the resistance per unit length of pipe. Now pipes are made in

standard sizes and of material which varies a good deal, but which has fairly fixed average values of resistance, and since it very often happens that one is concerned only with rather rough quantitative values, one assumes from the known dimensions of the pipe, and the known resistances of the material, the resistance of the length of pipe which is being dealt with, and in this way makes the interpretations of current.

It is possible sometimes to get at a rather better value by resorting to a procedure which consists in attaching to the pipe heavy leads that are brought out and connected with an ammeter. The potential difference between two portions of the pipe close to the place where these heavy leads are brought out is measured when these leads are not connected, and again when they are connected through the ammeter, and at the same time the value of the current, as shown by the ammeter, is measured. In the second case, when the ammeter is in circuit, the potential difference as shown by the millivoltmeter will be less than in the first case, and the reduction of voltage due to drawing a certain measured current from the pipe, gives an indication of the resistance of that length of pipe. For instance, if we find that by connecting the heavy leads we reduce the potential difference between the two points on the pipe to one-half of its former value, then we know surely that the original current flowing through the length of pipe was twice what the ammeter indicated.

However, the problem not only involves the determination of the current flowing in the pipe, but more particularly the current which is escaping from the pipe. How shall we determine that? The only way Dr. Sharp knows of doing that without seriously disturbing the normal conditions of the pipe is by taking some potentiometer measurements of the current flowing on lengths of pipe separated from each other by suitable distances. This may be taken by suitable instruments, and observers reading at the same time, or by sensitive and accurate recording instruments, which are also obtainable for this purpose. The interpretation of these results will give at least a rough measure of the current which is leaving the pipe at points between.

We can also get some indications of the probable escape of current from the pipe by exploring the electrical condition of the soil in its vicinity. If we start from the pipe and find a continuous fall of potential as we go from point to point away from the pipe, the indications are that current is flowing along such lines, and that these lines are stream lines of electricity. In making measurements of this kind it is advisable of course to use electrodes not subject to error due to polarization, that is, electrodes in zinc-sulphate solution, or similar electrodes, and make the measurements by a method which does not draw any current so as to eliminate resistance drop at the point where the electrode is inserted in the soil, that is, some form of potentiometer is indicated as the proper one here. Professor Harber's earth ammeter, as it is sometimes called, is also used for this purpose.

The discussion of Dr. Sharp's address was rather brief, Dr. Carl Hering questioning the value of the shunt method. Dr. Sharp admitted that it was satisfactory only with pipes of moderately high resistance.

The paper on "Electrolytic Corrosion of the Bottom of Oil Tanks," by A. A. Knudson, was then read and discussed by S. S. Sadtler, Carl Hering, A. L. Cushman, C. F. Burgess, W. H. Walker and J. W. Richards.

A paper on "The Function of Oxygen in the Corrosion of Metals," by W. H. Walker of Boston. It was not discussed.

Professor Baskerville was then called on to make an address. He spoke at length on the equipment and general educational work of the College of the City of New York, and particularly of the methods used in its chemical laboratories.

"The Theory of Electrolytic Paints," by Dr. W. D. Bancroft, was next presented, and its reading was followed without further discussion by "Simple Methods for the Prevention of Electrolytic Corrosion," by Prof. Maximilian Toch.

A. A. Knudson added another question to those that Professor Ganz had presented, which he set before the convention in the following words: "I have in mind two wrought-iron water pipes which are undergoing corrosion probably from chemical processes. These pipes run in a creek partly submerged and are negative to the soil at that point. There is a current of electricity flowing through it, sometimes reaching seventy-five and eighty amperes. I wish to ask if this current of electricity flowing through these pipes tends to assist the electrolytic action of corrosion on the surfaces from the chemical effect?"

Prof. Albert F. Ganz inquired if it it is necessary first to coat an underground pipe with a solution paint before applying the coating which will keep away the water. Mr. Toch explained that it would not be necessary to paint the pipe, although it is best to apply an insulating hydrocarbon paint, pouring half-neat cement around the pipe. This would be as cheap and better than pitch.

Allerton L. Cushman explained that the object of the inhibitor is to keep in contact with the surface of the steel a slightly soluble compound so that if any water gets through the excluding paint surface, upon reaching the steel the water must contain in solution some protecting derivative of iron. It was hoped, he said, that the scheme would work out practically, as theoretically the idea seemed to be all right.

Mr. Toch replied that in actual practice, when a beam or a billet is coated at the mill and transported, great chains being wrapped around it to hold and support it, besides the other surface injury to which it is subjected, no protective coating of .001 of an inch in thickness has been made that will withstand these attacks.

SATURDAY MORNING SESSION.

The Saturday morning session was held at the Chemists' Club on West Fifty-fifth street, and President Acheson, after calling the meeting to order, announced the paper on "The Lash Steel Process and the Electric Furnace," by F. A. J. FitzGerald, consulting chemist, Niagara Falls, N. Y.

Henry D. Hibbard spoke of the great advantage of the electric furnace in the production of heat without oxidation. When steel is made in the open hearth furnace, all the effects of oxygen are produced, the mingling of the carbon and silicon is carried out by oxygen, and in fact oxygen is the great servant used in produsing the results, but oxygen, while an excellent servant, always lies in wait to give all kinds of trouble, if one does not know how to handle it at the latter end. The oxygen must be fairly eliminated from the metal or the result is poor. In the electric furnace heat can be produced without oxygen, and from a steelmaker's point of view the process of making steel by such a furnace is simplified more than one can realize.

Prof. J. W. Richards said that there are two ways of making steel—one is simply to melt the ingredients together, and the other is to oxidize the pig iron so as to eliminate the impurities and get down to steel. These two processes require essentially different kinds of apparatus, for the reason that in the melting process it is simply a case of melting. In the oxidation process it is largely a case of having surface to oxidize the bath by means of the iron ore which is added. These two requirements are going to give rise to two different classes of furnace, each best adapted for its purpose. As to the question of losing iron in slag, that is not such a very serious one, because in ordinary open hearth processes there is considerable loss in slag. Electrochemists should not think that a process to be commercially successful must reduce the iron in the slag to a low point. There are open hearth furnaces running making steel successfully where they lose something like fifteen or twenty per cent of iron in the slag, but yet are commercially successful. The third point that Professor Richards made is that the electric furnace is being developed very largely by electricians and electrochemists, who in many cases are not experienced steel men, and the ideal combination is to get the experienced steel man with a first-class electrochemist to work on the proposition. Where a firm which is experienced in making steel secures the assistance of an electrochemist or an electrometallurgist to do the electrical work for them, the combination succeeds very nicely.

W. S. Landis contended that as he understood the Lash process, it is intended particularly for the reduction of iron ores and the final production of steel directly from them in the same operation, and it

seemed, therefore, that the loss of iron in the slag is rather an important item.

At the request of W. H. Walker, Mr. FitzGerald described the Lash process as consisting in making an intimate mixture of the cast iron, oxide of iron and carbon. The cast iron is in the form of bars, or shelf pig iron, and is supposed to act as a carrier for the carbon and also some metalloids contained in it; it undoubtedly acts as a reducer. The process seems to be extremely simple and has been carried out on a very large scale, many hundreds of tons of steel having been made in the open hearth process, showing economies over the regular practice. In the Lash process a much larger percentage of ore can be used and in the open hearth furnace there is no difficulty in reaching a yield of ninety-four per cent, which means a loss of six per cent in the metallic contents. The method of working has been to have a blast in the furnace and then to add the Lash mixture. In the electric furnace, in the experiments made, there was about sixty per cent of ore, about twenty-three per cent of cast iron, and the remainder fluxes and carbons.

A paper, entitled "The Latent Heat of Vaporization of Zinc," by W. McA. Johnson, was then read. It was discussed briefly by Dr. Hering and Professor Richards.

Dr. Carl Hering next presented a paper on the subject, "Heat Conductance Through Walls of Furnaces." It related to methods for decreasing the loss of heat through the walls of electric furnaces.

P. M. N. Dennie spoke of the value of a gas envelope about a furnace in increasing its efficiency. C. F. Carrier, Jr., discussed Mr. Hering's constant K or coefficient of conductivity and regarded it rather as variable. J. W. Richards said that in studying recently the heat radiation from a certain sort of furnace it was shown by experiment that after a certain wall thickness was reached there was no more use in putting on protecting material outside, as the increased effect from the additional material was practically negligible. Others discussing the subject were H. D. Hibbard, J. C. Parker, F. A. Lidbury and W. S. Landis.

The next subject on the programme was an address on "Utilization of Power Stations for Electrochemical and Electrothermal Processes During Periods of Low Load," by E. A. Sperry of Cleveland. Mr. Graves, of the Brooklyn Edison Company, then read the paper on "Electrochemical Loads and the Central Station," written by John Meyer of Philadelphia.

The discussion on these topics was opened by President Acheson, who, speaking of the carborundum furnace, said the duration of its run is thirty-six hours, so that it would overlap all the high points and valleys, and it is not, therefore, available for central-station work, but there should be many industries that could be fitted in. Probably not so largely in the case of the electric furnace, because after the furnace is once fairly heated up it is not well to let it go out because the initial heat in warming up the work represents a large amount of energy.

Edward R. Taylor said that there are many electric furnaces capable of intermittent work in that respect, but of course not to as good advantage as though running continuously for twenty-four hours. It would not be advisable to shut the current entirely off during the peak load. For example, if the furnace were run twelve hours and then stopped twelve hours, it would barely get started again. On the other hand, on the peak load the furnace could be kept hot, and just below the point of production, and then when the valley load came an increase of power could be put on, and the production proceed for twelve hours. The current could probably be cut off best for the two or three hours of the peak load.

Dr. Carl Hering declared that the energy required for heating up a furnace is generally so great that it is doubtful whether it would pay to use furnace processes intermittently, unless the loss during the non-working period can be made very small. He thought, therefore, that the more probable field of usefulness for spare current would be for electrolytic processes, which can be more readily stopped.

W. E. Wells thought that if the electrochemical interests could get together with the central-station men, arrangements might be made whereby during the greater portion of the year current could be furnished continuously; during another portion of the year current could be furnished continuously except on Saturday nights, and during another and very short portion of the year, amounting to not more than forty-five days, current could be furnished continuously, excepting a one-hour peak, or a peak ranging from one and a half minutes to five minutes. It may not be generally known, but the last twenty-five per cent of the capacity of a large number of electric-light stations is used only one hundred hours per year. That twenty-five per cent of capacity could be used the other 8,000-odd hours to a very good advantage.

Lawrence Addicks said that for copper refining plants the price of current would have to be very low to be attractive, as the process is very sensitive to changes in conditions, an alteration of even ten per cent in current density at different times of the day disturbing seriously the silver and gold alloys.

C. F. Carrier, Jr., believed there is one factor that is apt to be overlooked in this question. He had found as the result of a complete calculation of a plant for making metallic sodium that was to be located near a central power station that, if the central power station made any money, he could not make any money, and, if he made any money, the central power station could not make any money.

G. M. Kibbe argued that while waterpower is cheaper in most instances than power from any other prime mover, a location at a remote waterpower may still make the production costs higher than a location near a central station at tidewater, for instance. Tidewater shipping facilities, cheap labor and a nearer market for finished products may more than offset the economy of waterpower.

Prof. J. W. Richards referred to an electric-furnace plant in Switzerland which runs one heat in the morning and one in the afternoon, and is then shut down for the rest of the day. Such plants could arrange to make another heat, so as to fit in with hours that would be satisfactory to the central-station managers. There are also some electrolytic processes which can be absolutely stopped for a certain number of hours, not run on light load, but more easily stopped entirely for four or five hours, and then started up again without practically any hindrance at all. It would be well for electrochemists, in considering different kinds of processes, to consider whether the process cannot be modified, or practically stopped, to fit in with the number of hours when current can be got at the cheap rate.

P. M. N. Bennie said the large generating companies at Niagara Falls are also acquainted with the load-factor problem, and they have been looking for the same solution right among these works, and they have not found it. He thought perhaps there has been a good deal of dreaming on this idea of getting an intermittent load and making it a success. There has been a great deal of work done on it, but there has not been any solution of it.

Lawrence Addicks believed that the relative importance of the power cost in the electrochemical industry to the total cost is not fully understood. There is an impression that it is a much larger item. From his experience in the copper-refining business the power runs at about twenty-five per cent of the cost, so that a saving in power may easily be outbalanced by other factors.

Others discussing the subject were Messrs. FitzGerald, Hibbard, Graves, Kohn, Wells, Breed, Sadtler and Sperry.

Edward R. Taylor was then called on to outline the objects of the appointment and the work of the national conservation committee.

On motion of Dr. Hering a vote of thanks was tendered to those who had participated in making the arrangements and promoting the success of the convention. The meeting then adjourned.

Among the entertainment features provided were a luncheon and organ recital on Friday noon at the College of the City of New York, a dinner at Reisenweber's on Friday evening and a smoker at the Chemists' Club on Saturday evening. On Saturday afternoon a visit was made to the Balbach Smelting and Refining Works at Newark, N. J., where the process of smelting and refining of lead, copper, silver and gold were inspected with much interest.

Electrical Ordinance for Atlanta, Ga.

What fire underwriters and electrical men in general regard as a model electrical ordinance, has just been adopted by the city council of Atlanta, Ga. The ordinance provides for a board of electrical control and regulates the construction and installation of electrical work and equipment. It goes further than almost any set of regulations previously framed anywhere for this purpose, and if properly observed should reduce to a minimum the hazard from improper wiring. A digest of the text of the ordinance is given here. The ordinance was framed by A. M. Schoen, chief engineer of the Southeastern Underwriters' Association, at the request of the city authorities.

The ordinance creates a board of electrical control, to consist of the chairman of the committee on electric lights, telegraph and telephones, the city engineer, the chief of the fire department and the chairman of the committee on electric and other railroads, the first named official to be the chairman of the board. It is the duty of the board of electrical control to have inspected all electrical construction, installations and equipments of any kind which it has the power to order removed, repaired or rebuilt, when, in the board's judgment, life or property will be better protected thereby. The board is charged with the duty of enforcing all laws relating to electrical energy and construction, and is empowered to pass upon the ability and responsibility of applicants to do electrical contracting in the city of Atlanta.

In January of each year the city council is to elect a competent man for the position of superintendent of electrical affairs, who is to receive a salary of $1,800 per annum and be subject to the orders of the board of electrical control. The superintendent of electrical affairs regulates and determines the placing of wires or other appliances for electric light, heat or power. In the discharge of his duties the superintendent is privileged to enter any building, manhole or subway, or to climb any pole, for the purpose of examining and testing electrical appliances. He has also authority to compel the removal of superfluous poles which may impede travel. The superintendent of electrical affairs inspects, approves and issues certificates of satisfactory inspection of all wiring. With the aid of the officers of the police department who report the operation of lights in the district, he has general supervision of city lights, requiring all concerns furnishing lights to the city to comply with the terms of their contract.

All electrical construction, material and appliances must conform to such special rules as may be adopted by the board of electrical control, and to the rules and requirements of the National Board of Fire Underwriters. No wiring or alteration in wiring for light, heat or power, or increase in the load carried is to be made without a written permit from the superintendent of electrical affairs.

The superintendent has authority to cut off the current in case of failure to comply with the ordinances. The use of metal conduits only is permitted for wiring buildings within the fire limits.

Failure to comply with the ordinances or an order or request made by the electrical superintendent by the authority of these ordinances is punishable by a fine of not less than $25 nor more than $100 for each offense, or thirty days' imprisonment. Before engaging in electrical construction it is first necessary to obtain a license, the fee for which is $25, although an establishment employing a man of electrical knowledge and experience may have the employe take the examination and be granted a license to do electrical work only in the establishment or building in which he is employed, upon payment of a fee of $5. Any person, firm or corporation found doing electrical work in the city of Atlanta without a license is subject to a fine of $100 or imprisonment for thirty days, or both. Licenses are for one year only and are not transferable.

Brooklyn Modern Science Club.

The Modern Science Club, 125 South Elliott Place, Brooklyn, N. Y., under whose auspices illustrated lectures on civil, electrical, hydraulic, mechanical and marine engineering subjects are held, announces the following forthcoming numbers on its fall programme:

November 10—L. J. Wing, of L. J. Wing Manufacturing Company, "Practical Results in Forced Draft Installation."

November 17—William T. Donnelly, M. E., "Transportation by Water."

November 24—C. J. Simeon, of the Avery Scale Company, "Automatic Scales in Modern Industries." With particular reference to the weighing and handling of coal.

Saturday, November 28, will be the date of a special lecture and general discussion upon the subject of "Patent Office Experiences."

Use of Electric Power for Safety in Mines.

The United States Geological Survey has issued a report on the prevention of mine explosions, submitted by three foreign experts, Victor Watteyne, inspector-general of mines, Belgium; Carl Meissner, councilor for mines, Germany, and Arthur Desborough, his majesty's inspector of explosives, England.

Among the recommendations of the report are these on the use of electricity:

"Electricity in mining operations offers so many advantages and has been so generally adopted that no reasonable objection can be made to its use under proper restrictions. The electrical equipment, however, should be installed, maintained and operated with great care, and so safeguarded as to minimize danger from fire or shock. The fact that the effectiveness of some insulating materials is soon destroyed in most mines should not be lost sight of.

"We recommend the following precautions: For distribution underground the voltage should not exceed 650 direct current or 500 alternating current, these voltages being intended for transmission to machinery operating at 500 volts direct current and 440 volts alternating current, respectively. Even lower voltages are preferable. The trolley wires should be installed in such manner as to render shocks least likely—that is, placed either high enough to be beyond easy reach or at one side of the track and properly protected.

"Where current at a potential of more than 650 volts is employed for transmission underground, it should be transmitted by means of a completely insulated cable; and where a lead or armored covering is used, such covering should be grounded.

"In all mines having electric installation special precautions should be taken against the setting on fire of coal or timber. Inclosed fuses or cut-outs are recommended, and each branch heading should be so arranged that the current may be cut off when necessary.

"No live electric wire should be permitted in that part of any mine in which gas is found to the amount of two per cent.

"In all mines producing gas in dangerous quantities, as indicated by a safety lamp which will detect two per cent of gas, the working places should be examined for gas by a qualified man using such a lamp immediately before any electric machine is taken or operated there."

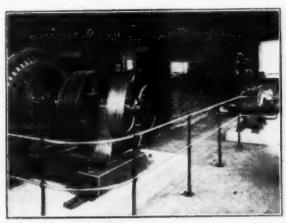
ELECTRIC POWER IN THE COLLIERIES OF SOUTH WALES

BY A. H. BRIDGE.

During the last few years the South Wales district has been the most fruitful one in the United Kingdom for the electric mining engineer, for in it quite a number of important installations have been put down for some of the principal colliery owners. It is reasonable to expect that the next few years will be even more satisfactory in this respect, both in the matter of new plants and in the extension of those already down. Two things of interest as leading to this anticipation are matters of general comment just now. One is the almost certain extension of electrical application in mines now that the demands for heavy output of coal which have been a remarkable feature of the last year or so, have lessened somewhat, giving a favorable opportunity for bringing the equipments of the mines up to date. The other is the greater application of electricity that is expected to follow as one result of the proposed, but at present deferred, legislation for a miners' eight-hour day.

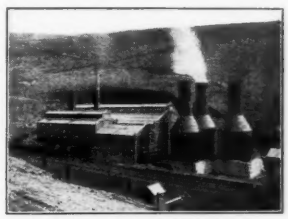
It will be remembered that it was in the South Wales district that a large power company carried on extensive operations supplying large power users from several generating stations, but came to such a disastrous experience, ending in financial breakdown, loss to a number of firms in British electrical engineering industry, disfavor for electrical investments —indeed it was one of the severe blows that our electrical industry sustained a few years ago and has not recovered from yet. The company came to such a pass that the customers who were colliery and works owners dependent upon it for the supply of energy necessary for preventing an interruption of their industrial operations, had to step in and take the helm. The company, as has been recorded in these pages, has since passed through various other stages in which several smaller subsidiary companies have been formed to operate certain of the stations and supply energy in their neighborhood. Before the crash came, however, the company did excellent educational work among many of the mines, and there was promise of a most satisfactory development straightaway. Whether the course of colliery electrification in South Wales was greatly interfered with by reason of the Power Company's tribulations is one of those matters upon which a pretty safe guess might be made. However, things are now undoubtedly going ahead well, and nothing appears likely to stay the progress that has well begun. Three interesting undertakings, each of which has had its own electric generating station put down, may be mentioned in this article, namely: (1) The Aberdare collieries of the Powell-Duffryn Company; (2) the Cambrian collieries, in Clydach Vale; (3) the Ferndale collieries—the most recently completed system of the three.

NOS. 8 AND 9 PITS, TYLORSTOWN.

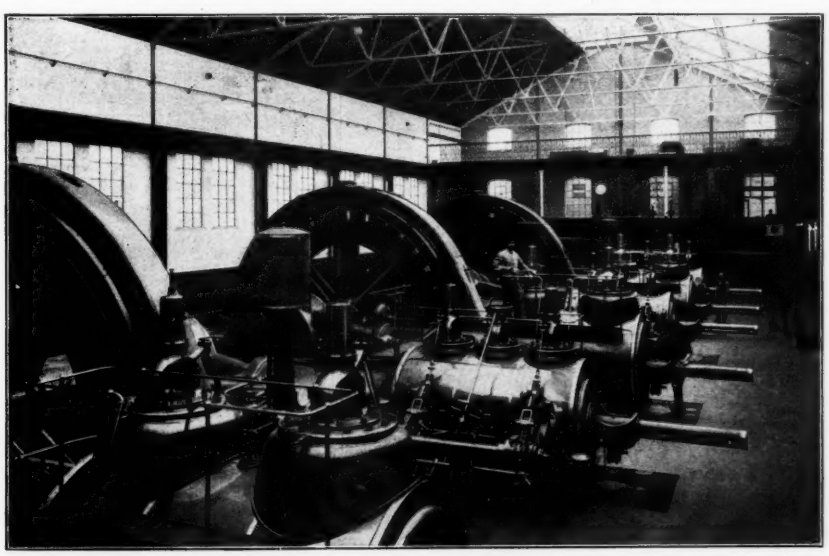


NO. 9—FAN HOUSE INTERIOR.

NOS. 1 AND 5 PITS, FERNDALE.



POWER STATION.



FERNDALE COLLIERIES—POWER STATION ENGINE ROOM

THE ABERDARE COLLIERIES.

The equipment of the Aberdare collieries was put down to the designs of Charles P. Sparks, who acted as consulting engineer. He was responsible for the rearrangement of the electrical system under which a number of the pits had worked for several years, and for a great extension scheme. The Aberdare collieries, which are about twenty miles northwest of Cardiff, raise about half the annual output of the Powell-Duffryn Company, which was, a year or two ago, close upon three million tons. Six out of the nine pits were worked by isolated direct-current plants (200 and 400 volts), but these small plants gave way in the development scheme to one large power station for serving the entire pits in the valley, 3,000-volt, fifty-cycle, three-phase current being generated, and overhead transmission

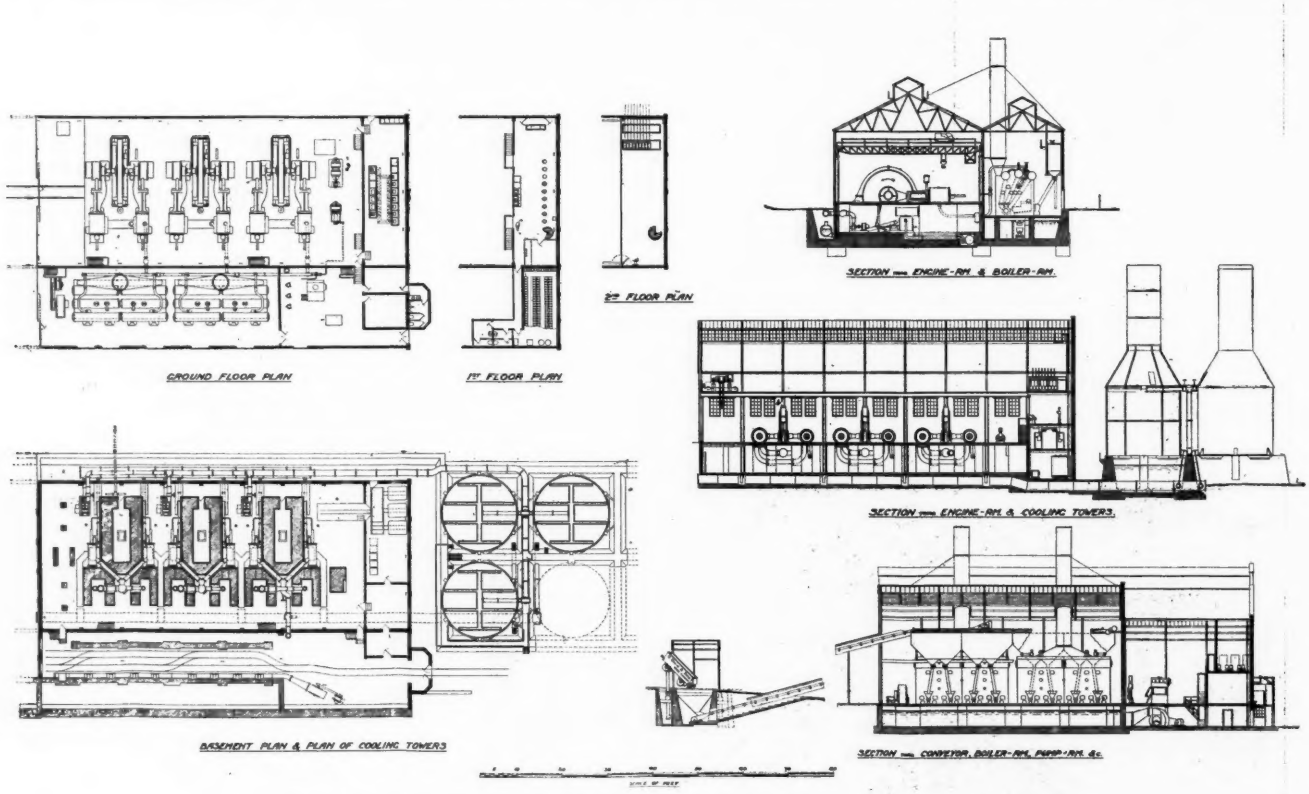
lines being employed. When this new power station commenced operations some three years ago 4,600 horsepower of motors were at work out of a total of 6,000 horsepower. The power-station plant comprised a number of 2,000 and 1,000 kilovolt-ampere, three-phase alternators, supplied by the Electrical Company, Limited (A. E. G.), each driven by Yates & Thom horizontal cross-compound, jet condensing type steam engines, which were served from Babcock & Wilcox water-tube boilers. A very detailed account of the plant, transmission lines, sub-stations, and the various operations performed in the mines was given by Mr. Sparks in a paper that he read before the Institution of Electrical Engineers in London. A number of main and tail haulage machines driven by 150-horsepower, 3,000-volt, 290 revolutions per minute, variable-speed motors; fans driven by 180-horsepower motors of the same speed and pressure; screens rope-driven from sixty-horsepower, 3,000-volt, enclosed motors (485 revolutions per minute); an aerial ropeway driven by fifteen-horsepower motor; three-throw ram-pumps; winding machine with 100-horsepower motor (depth of pit ninety yards), giving an output of seventy tons of coal per hour, also a winder in a staple pit, driven by an eighty-horsepower motor—these are some of the representative examples.

THE CAMBRIAN COLLIERIES.

The Cambrian collieries, which are in Clydach Vale, produce in three pits about 1,000,000 tons per annum. Steam working gave way to electrical operation for working haulages, pumps, coal-cutting machines, the supply being first obtained from the Power company to which reference is made above. C. P. Sparks, who was the consulting engineer in this case, also persuaded the authorities to put down their own power plant. This consists of three 1,000-kilovolt-ampere Siemens, three-phase, rotating field type alternators, generating a 2,200-volt, twenty-five-cycle current. These alternators are driven by Belliss steam engines, and the speed of the sets is 250 revolutions per minute. The boilers are thirty feet by nine feet, Lancashire type, with Sugden superheaters. A small steam-driven set and two seventy-kilowatt motor-generators supply direct current for auxiliary purposes. Step-down transformers (2,200 to 400 volts) are fitted at one end of the switchboard for giving the supply to the surface and auxiliary motors. Some twenty-one induction motors aggregating 1,890 horsepower and ranging from 220 horsepower to three horsepower serve for the principal operations. The greater part of the supply is taken into the mine at from 2,000 to 2,200 volts and is received by the motors at that pressure.

THE FERNDALE COLLIERIES.

By the courtesy of W. H. Patchell we are enabled to give in fuller detail the particulars and illustrations of the last completed of the three undertakings named, i. e., the Ferndale collieries installation, for which he was consulting engineer. Here again a special power station has been put down. This is situated at Tylorstown, and the building is constructed on a steel frame which sustains the whole weight of the roof and upper floors, the brickwork serving merely to clothe the skeleton. The reason why this type of building was adopted was the ever present possibility of subsidence at the surface of a colliery. The north end of the station is temporary, so as to admit of future extensions. The building is served by a twenty-five-ton overhead traveling crane having a sixty-seven-foot span.


GROUND FLOOR PLAN
1ST FLOOR PLAN
2ND FLOOR PLAN
SECTION thro ENGINE-RM & BOILER-RM.
SECTION thro ENGINE-RM & COOLING TOWERS.
BASEMENT PLAN & PLAN OF COOLING TOWERS
SECTION thro CONVEYOR, BOILER-RM, PUMP-RM &c.

PLAN AND SECTIONAL VIEW, POWER STATION, FERNDALE COLLIERIES

Four water-tube boilers of the Stirling three-drum type are installed, each having 6,209 square feet of heating surface. Each boiler is provided with two underfeed mechanical stokers and a superheater of the McPhail type with 800 square feet of heating surface, and is capable of evapo-

rating 30,000 pounds of water per hour at a pressure of 180 pounds per square inch and imparting a superheat of 150 degrees Fahrenheit.

The stokers are worked by a system of forced draught, which is supplied by two Musgrave fans, each being belt-driven from a motor.

The boilers are arranged in two batteries, each battery being connected by a breeched piece to a steel chimney seven feet in diameter and seventy-five feet high.

The coal used is run into Messrs. D. Davis & Sons' private siding from the Taff Vale Railway, where the wagons are

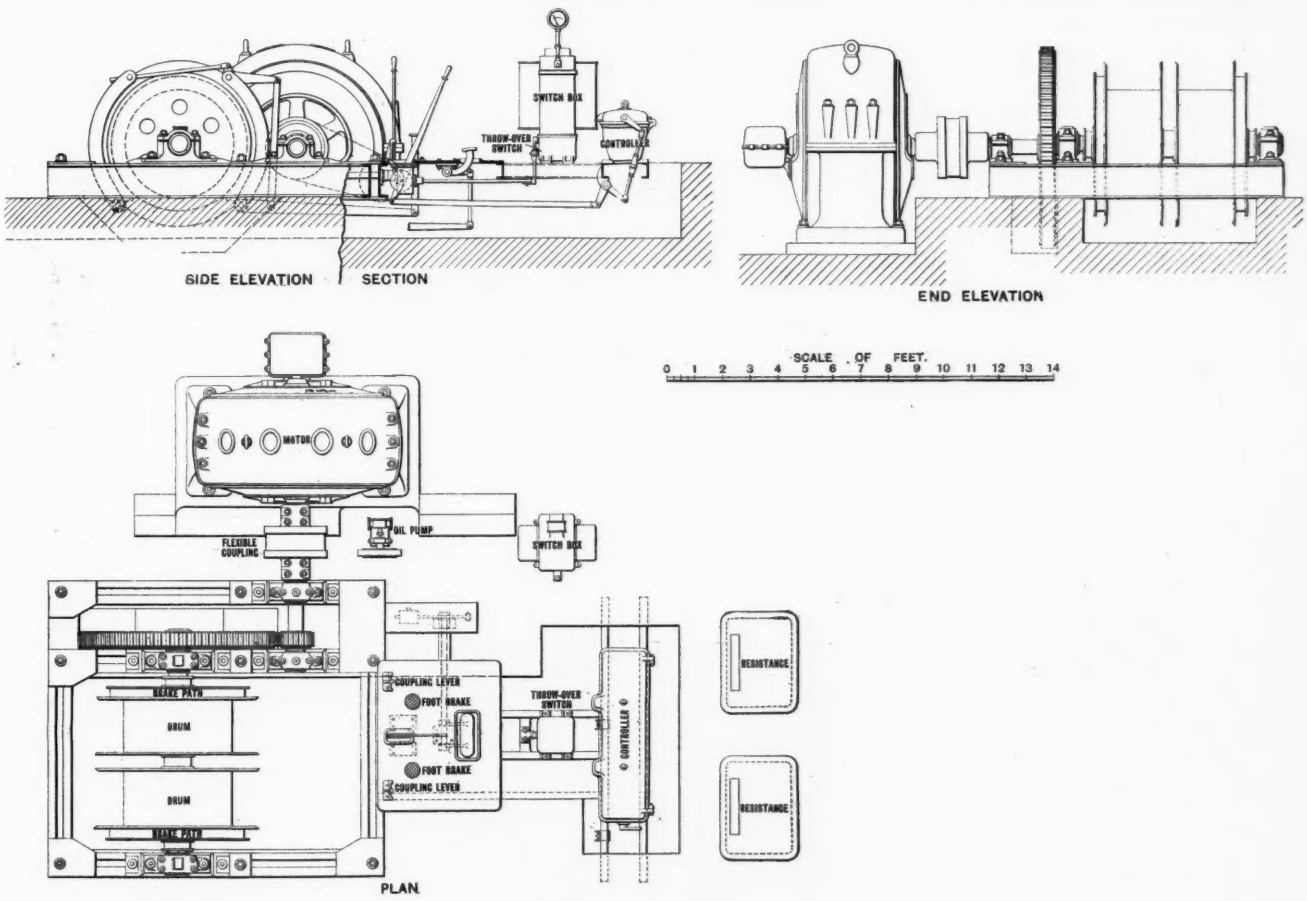
The ash from the stokers is removed by opening a sluice valve under the boilers, when the ash falls into narrow-gauge trucks in the boiler-room basement.

The water supply is pumped from Messrs. Davis's No. 8 pit, close by, and is stored in a large cast-iron tank outside the building. There is also storage in a large tank 100 feet long under the boilers.

The feed pumps, of which there are three, are of Messrs. Clarke, Chapman's make, tandem-compound, each capable of delivering 5,000 gallons of water per hour against the boiler pressure.

The exhaust steam from the pumps is

low-pressure, fifty-six inches; the stroke, fifty-five inches; speed, ninety-four revolutions per minute; working pressure, 170 pounds per square inch, with superheat of 150 degrees Fahrenheit at the stop valve. Each engine is supplied with two jet condensers and feed-water heaters. The injection water is taken from cooling tower concrete tanks through a main four feet in diameter buried in the engine basement floor, and after passing through the condensers is collected in a wrought-iron hot-well main. The circulating water is lifted to the cooling towers by centrifugal pumps connected to the hot-well



ARRANGEMENT OF THE 200-HORSEPOWER HAULAGE, FERNDALE COLLIERIES

tilted by hydraulic rams which are worked from the boiler feed pumps. The coal having been tilted into a hopper, it is then carried by a motor-driven inclined band conveyor into and along the boiler room, where by means of a throw-off carriage the coal is discharged into the bunkers above the boilers, which have a capacity of 150 tons, and is carried by chutes at the bottom of the bunkers to the stoker hoppers. The conveyor carries twenty tons of coal per hour and runs almost noiselessly.

taken to a Cochrane open-type exhaust steam heater, where it heats the feed water on the suction side of the pumps.

For use in emergency there is provided a Worthington tank pump, which draws from the river in the unlikely event of water from the mine failing.

The three main steam engines are of the cross-compound type made by Messrs. Sulzer Brothers, each capable of giving 2,500 horsepower at normal load. The dimensions of the cylinders are, high-pressure, thirty-three and one-half inches;

There are three natural draught wrought-iron cooling towers thirty-three feet in diameter and eighty-three feet high. The circulating water enters about thirty feet from base and is discharged into wooden troughs, which equally divide the water on cross timbers beneath, and so break it up into a fine rain; after cooling the water is collected in the concrete tanks under the towers.

The three-phase generators, coupled direct to Sulzer engines, are of the revolving-field, flywheel type, each having a nor-

mal continuous output of 1,600 kilowatts at a power factor of 0.85 and a potential of 2,200 volts, and having an overload capacity of twenty per cent for two hours, or thirty per cent for half an hour. The guaranteed temperature rise is not to exceed forty-five degrees centigrade after ten hours' full load run as measured by thermometer. These generators are of the Lahmeyer Electrical Company's make.

The total weight of each generator is 107 tons; of the revolving field, approximately seventy-five tons. The generators are separately excited at 200 volts from a seventy-five kilowatt Bellis-Lahmeyer exciter running at a speed of 525 revolutions per minute.

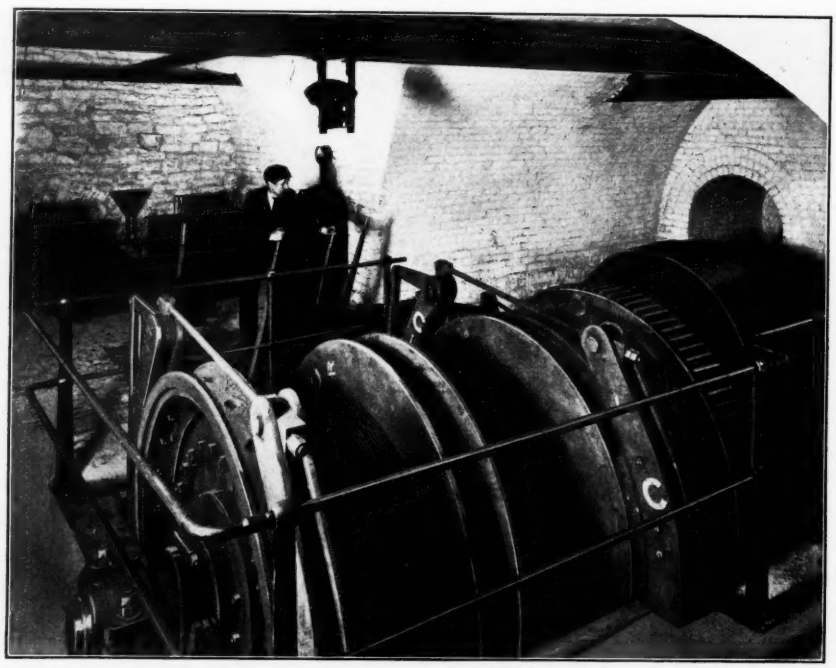
As a spare to the Bellis exciter there is a 100-120-kilowatt motor-generator booster set, consisting of a 180-horsepower, 2,200-volt, three-phase motor, coupled to a shunt-wound, 120-kilowatt generator. The booster is mounted at the end of the shaft and is capable of raising the voltage from 200 to 290 volts to charge the Tudor battery; the latter has a capacity of 380 ampere-hours when discharging at a thirty-eight-ampere rate and consists of 115 cells. The regulation is done by hand by a twenty-one-contact regulating switch. The battery can also be charged by the Bellis set, the generator of which is arranged so that its voltage can be increased to 290 volts in order to allow of its acting as a spare in case of a breakdown in the motor-generator set.

The electric current is taken from the generators to the main switchboard, which is situated at the south end of the building and is of the most modern type. The operating platform is occupied by a series of desks from which the main generators are controlled and switch pillars controlling the feeders. These desks and pillars merely carry switch-handles and low-tension instruments. The actual switches themselves are enclosed in a lower story. This has the advantage of giving ample room for the disposition of the high-tension gear in a chamber which need only be visited for the purposes of inspection and leaves the switchboard operators free to attend to their duties on the platform, which is claimed to be even safer than a switchboard of an ordinary low-tension station. These switches have been provided with Ferranti time-limit relays.

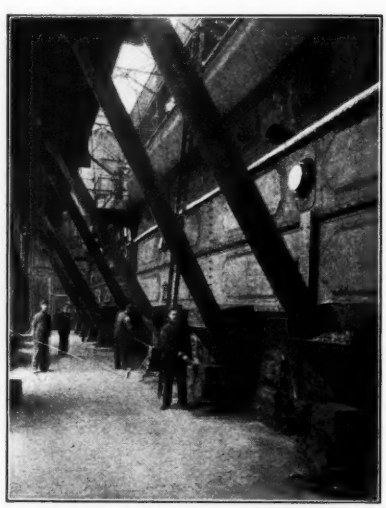
The current is taken from the power station by main feeders to distributing centers at the various pits. The motors are generally worked at 2,200 volts, but in certain places, in accordance with the Home Office rules, the current has to be stepped down by transformers to 400 volts.

Nos. 6 and 7 pits are only about 900 yards from the power station; the current, therefore, is taken direct to them at 2,200 volts. In the case of Nos. 1 and 5 pits, at Ferndale, which are 2,500 yards away, and Nos. 2 and 4 pits, which are some 2,000 yards further up the valley, the current is stepped up to 6,600 volts and transmitted by bare overhead wires which are run on duplicate poles. Step-down transformers are fixed at sub-stations convenient to the pits, where the pressure is again reduced to 2,200 volts, or 440 volts, as required.

Some twenty-two haulages are being installed, varying in size from 200 horsepower to fifty horsepower. The gears were made specially heavy, to Mr. Patchell's specification, by the Uskside Engineering Company. Slow-speed motors have generally been adopted and the electrical equipment is of massive construction supplied by the Lahmeyer Company. The controllers are of a new design arranged by the consulting engineer.



200-HORSEPOWER HAULAGE IN NO. 1 PIT OF THE FERNDALE COLLIERIES



BOILER HOUSE IN POWER STATION OF FERNDALE COLLIERIES

The haulages are generally of main and tail type and work at a speed of six miles an hour. They are principally of single reduction, but in some cases to suit the exigencies of the positions in which they had to be installed, double reduction type has been chosen. In all cases there is a flexible coupling between the motor and the gearing which to a very large extent takes the jar of the gear off the motor. These electrically driven gears are very popular with the drivers; and, owing to their reliability and ease of working, not only have great economies been effected over the old steam-driven haulage gears, but it has also been possible to obtain a greatly increased output, as there are no delays in starting up, the haulage gear commencing work immediately the driver manipulates the lever.

The underground pumping is now being handled electrically; in some cases by three-throw pumps made by the Usk-

side Company, and in other cases by high-lift Sulzer centrifugal pumps.

VENTILATION.

Ventilation is a most important part of the work, not only from the colliery manager's point of view, but also inasmuch as the continuous user makes it a most desirable load for the power station. At the new pit a "Sirocco" fan has been put down to handle 300,000 cubic feet of air per minute at a four-inch water gauge. This fan is driven electrically from either end of its shaft by two Lahmeyer motors working at 2,200 volts. One of the "Schiele" fans, which has been driven for several years by a steam engine and supplying 300,000 cubic feet of air per minute at 3.5-inch water gauge, has lately been converted to an electrical drive. Two other "Sirocco" fans are at present being installed.

The new pit is being entirely equipped with electrical machinery, including a winder, which is being manufactured by the Lahmeyer Electrical Company. It will work on what is known as the "Ilgner" system and is constructed to raise 1,800 tons of coal a day.

The consulting engineer, W. H. Patchell, of Caxton House, Westminster, has for many years been largely identified with the introduction of electricity for mines and was the electrical member of the Home Office Departmental Committee of Great Britain for the drafting of suitable rules for the use of electricity in mines. He has collaborated throughout with David Hannah, manager to the Ferndale collieries.

We understand that what is claimed to be the first large electric winding engine erected in the United Kingdom has just been put down at the Maritime pit of the Great Western Colliery, Pontypridd. In this case G. J. Hooghwinkel is consulting engineer.

Telephone Company Demands Portion of Telegraph Tolls.

The Cumberland Telephone Company has made a demand on the Western Union and Postal Telegraph companies, at New Orleans, for fifteen per cent of the tolls of messages which they transmit over the telephone instead of by messenger. The telegraph companies assert their right to use the telephones for any legitimate purpose, and refuse to pay the commission demanded, which makes it likely that they will order their instruments removed, for this was done under similar conditions in Chattanooga.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

MONTGOMERY LIGHT AND POWER.

The Montgomery (Ala.) Light and Power Company's report for the year ended June 30, 1908, is as follows: Gross, $320,375; expenses, $151,508; net, $168,867; interest, $103,194; surplus, $65,673; reconstruction reserve, $12,000; net profits, $53,673; equal to 2.6 per cent earned on the $2,000,000 capital stock. The net profits for the preceding year were $48,983.

PORTO RICO RAILWAYS.

The report of the Porto Rico Railways Company for the month of September and nine months ended September 30 shows as follows: September gross, $34,082; expenses, $19,649; September net, $14,433; nine months' gross, $277,233; expenses, $159,278; nine months' net, $117,955, as compared with $107,142 for the preceding year, an increase of $10,813.

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of September and nine months ended September 30 is as follows: September gross, $583,876; expenses, $276,588; September net, $307,288; charges, taxes and preferred dividends, $138,667; September surplus, $168,621; nine months' gross, $4,765,801; expenses, $2,372,024; nine months' net, $2,393,776; charges, taxes and preferred dividends, $1,145,122; nine months' surplus, $1,248,654, as compared with $1,323,094 for the same period of 1907.

DETROIT UNITED EARNINGS.

The report of the Detroit United Railway Company for the month of September and nine months ended September 30 shows as follows: September gross, $668,489; expenses and taxes, $423,136; net, $245,353; other income, $5,028; total income, $250,381; charges, $135,049; surplus, $115,332, comparing with $114,478 for September, 1907. January 1 to September 30: Gross, $5,324,855; expenses and taxes, $3,395,252; net, $1,929,603; other income, $45,055; total income, $1,974,658; charges, $1,218,860; surplus, $755,798, comparing with $888,241 for the corresponding period of last year.

LITTLE ROCK RAILWAY AND ELECTRIC.

Little Rock Railway and Electric's earnings for September and nine months ended September 30 are as follows: September gross, $54,655; expenses and taxes, $27,340; September net, $27,315; charges and sinking fund, $10,605; balance, $16,710; other deductions, $3,000; September surplus, $13,710, comparing with $21,592 for 1907. Nine months' gross, $495,817; expenses and taxes, $254,909; nine months' net, $240,908; charges and sinking fund, $90,796; balance, $150,112; reserve funds, $27,000; nine months' surplus, $123,112, which compares with $147,753 for the corresponding nine months of 1907.

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of September and nine months ended September 30 is as follows: Month of September: Gross, $222,891; expenses and taxes, $111,899; net, $110,992; other income, $61; total income, $111,053; charges, $71,976; surplus, $39,077. January 1 to September 30: Gross, $1,864,822; expenses and taxes, $1,019,823; net $844,999; other income, $3,072; total income, $848,071; charges, $635,743; surplus, $212,328. This is a decrease of $7,176 from the surplus for the corresponding months of the preceding year.

MEMPHIS STREET RAILWAY.

Memphis Street Railway's report for September and nine months ended September 30 is as follows: September gross, $143,044; expenses and taxes, $88,971; September net, $54,073; interest charges, $35,532; balance, $18,541; reserve fund, $2,500; September surplus, $16,041, compared with $20,304 for September, 1907. Nine months' gross, $1,199,765; expenses and taxes, $760,319; nine months' net, $439,446; interest charges, $314,970; balance, $124,476; reserve fund, $22,500; nine months' surplus, $101,976, as against $136,037 for the preceding year.

BIRMINGHAM RAILWAY AND LIGHT.

The Birmingham (Ala.) Railway, Light and Power Company's report for September and nine months is as follows: September gross, $177,891; expenses and taxes, $122,266; September net, $55,625; charges and sinking fund, $43,617; September surplus, $12,008, as against $29,363 in 1907. Nine months' gross, $1,586,026; expenses and taxes, $1,037,924; nine months' net, $548,102; charges and sinking fund, $394,772; nine months' surplus, $153,330, as against $190,013 for the corresponding quarters of 1907.

TWO-MOTOR-DRIVE WEB PRINTING PRESS, MANUAL CONTROL.

BY S. H. SHARPSTEEN.

A diversity of opinion exists among newspaper people as to which is the better, manual or automatic motor control. This is due in part to there being no data compiled to which the printer can refer and get the information that will enable him to review clearly all the questions involved.

The man in charge of the apparatus that drives the presses to print one of the large New York city dailies, when asked why he did not install automatic or push-button control on a web press, recently purchased, said, that he had just about press capacity sufficient to produce the editions in the allotted time, and that he was compelled to use apparatus with the least complication to permit of easy inspection.

In another press room of a metropolitan daily, where there is a recent installation of newspaper web presses, the electrician stated that the coils in the automatic devices sometimes burned out. On asking him what was done if a solenoid coil failed while a press was producing, he replied that in such an emergency the press was shut down until a coil could be taken from the control panel of an extra press equipment. The coil could be changed from one panel to another more quickly than the plates could be transferred from press to press.

It is now pretty generally understood in the newspaper world that where automatic or push-button control is used in the press room of a large daily, an extra press and electrical equipment is necessary to allow repairs when the control of an equipment goes out of commission. As a precaution an extra press would probably be installed regardless of the control in a new, large newspaper plant.

The business manager of a New York daily investigated web-press drive and control during eighteen months or more. Newspapers throughout the United States that were using electrical drive and control were consulted and the data thus received were carefully arranged by an electrical engineer. Manual control was chosen and installed; one man at the controller is responsible for the movement of the press. The only remote control used in this installation is the emergency stop, push-buttons being placed in positions of easy access about the press, to be used in case it is desired to stop the press quickly.

The men in a press room are often placed under a mental strain that tends to cause them to do foolish things. As an example: After the stock exchange closes there is a rush from the time the last news comes into the office of an evening publication, until the papers are being delivered. The newsboys are anxious to be first on the street with the Wall Street editions, and the delivery men have trains that should be met. As the last plates are securely fastened and the familiar roar of the presses goes out, there is a general stir among the people who take the papers. The business manager, possibly in a distant office, has been anxiously looking at the indicators, and as the presses are going on time he settles back in his chair with a contented expression on his face. Now let something happen in the press room that cuts short the product about the time the papers commence to pass out, and excitement seizes every man about the place. A short holdup is not important, but long delays at such time are serious, and each pressman is usually very eager to hurry things all he can to get the press running. With control stations located about the press room and possibly on a floor below, men will sometimes push the wrong button or one man pushes a button causing the press to do one thing, and another man at some other station pushes a button to perform a different movement, and serious trouble may follow. Much time and money have been spent to make automatic control devices interlocking to prevent trouble of this kind, but it seems impossible. With automatic control the service switch, through which current passes for all the devices of an equipment, is located, as a rule, on the controller panel in some remote place near a wall to which the panel can be fastened, and which also makes a fireproof back for the resistances. If the complicated devices for quick shutdown operated by a small switch or push-button and many feet of small wire gets out of working condition and some trouble with the press requires a quick stop, the pressman must hunt, possibly, on a long row of panel boards among many switches, for the one that will cut the equipment in distress from the line. If the motor did not respond to the emergency button, the slowdown and stop button would bring the equipment to rest, but might be too slow to save serious trouble. A second or duplicate quick-stop device could be installed to make an emergency stop more sure. In some cases a dynamic brake is used on large press equipments, in connection with an emergency stop, and these should be tried every day, while the press is out of use, to see if they are in good working condition. When a large web press is running at a high speed and is stopped quickly by the use of a dynamic brake there is excessive strain on press and motor, in many cases pitting the commutator; hence, the tests are seldom made, and defects not properly looked after.

There is another side of this question. The home of a newspaper is of interest to the masses who read the paper. An imposing building, properly equipped inside, is important; a number of modern presses controlled as if by magic is no small factor in swaying the mind of the public.

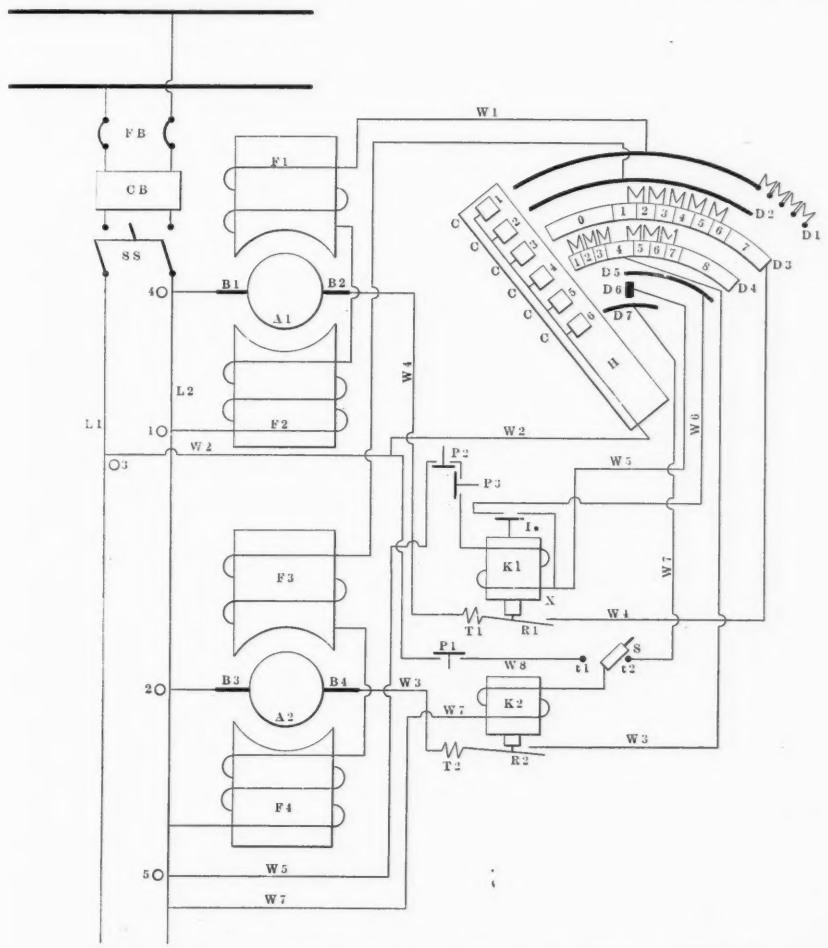
Important dailies that have automatic control keep a good electrician constantly in attendance, especially when the presses are running. This is a reflection on the electrical industry. The proper electrical apparatus, when well installed, to drive a web printing press, should not demand as much attention to keep it going as a train of cars in the subway. The idea of having an electrician constantly on duty when a web press or presses are running is as unnecessary as it would be to have a high-priced electrician on every subway train. When running pastes are made on the floor below the press room and presses, it is convenient to have a press-control station near the paper supports, to enable an employe that is looking at the paste as it is made, to operate the press in a proper manner. In many cases the manual control could be located to allow the operator to see, through a hole in the floor, the pasting being done. A few signal lamps, a speaking tube, or a similar device, could be used.

The diagram herewith illustrates a simple form of two-motor drive and manual dial-type controller, F B being two cartridge fuses, one in each side of the circuit. If the ordinary bare fuses are used they should be enclosed in a fireproof box.

A web-press equipment should contain a substantial double-pole knife switch provided with a make-and-break device that will prevent arcing at the blades and jaws, especially if it opens and closes the field or fields of the motor or motors. The service switch S S ought not to be left to a contractor to buy in the market what is called standard goods. It should be a first-class article of a type that has proven by long and hard usage that it will stand printing-press work without requiring

special attention. In many cases a switch of a certain amperage has been specified, the contractor selecting, from a catalogue, the cheapest one of the required capacity, that the fire underwriters will pass. With an ordinary stationary motor that is stopped and started but twice each day this switch might answer, but in web-press work, with manual control the switch is opened and closed many times each day, and constant use causes the pressman to handle it roughly. This switch ought to be placed on a substantial support near the controller, to enable the pressman operating the press to open it quickly in case a rush a pressman might unintentionally do the same, causing a short-circuit, burning his arm or hand, and damaging a switch jaw or blade, making a delay in getting off an edition. These switches are sometimes placed in a small fireproof box and provided with lock and key to prevent the circuit being closed by some careless person when the pressmen are away.

When a web press is to be driven by an electric motor, if the current is to be taken from a large generator or from street service, it is well to understand that large quantities of electricity are ready to rush in and cause the motor to develop



TWO-MOTOR-DRIVE WEB PRINTING PRESS, MANUAL CONTROL.

of trouble that puts out of commission the other press-stopping devices, and since both polarities of the circuit come close together at the jaws and blades of the switch, it should be located between two slate or marble pieces to prevent wrenches or other tools being carelessly put across it, causing a bad burn. It is a familiar sight to see a careless employe use the hand that contains a wrench or oil can to open a switch on a printing press. In double its normal power or torque, or make a bad flash and burn if the insulation fails. It takes time for a fuse to blow, and since electricity is so quick, and there is such a large quantity to come, the sure way to protect a motor installation is by installing a double-pole circuit-breaker at C B, made by a responsible company, the breaker having a good record. In the press room of one of the Baltimore dailies a press, equipped with motor drive, while standing still, the controller at the off position, was wrecked by the insulation breaking down between the frame of the motor and one of the series coils, allowing an excessive current to pass through the series winding and the armature with small or no resistance in circuit.

A good breaker, properly set, should have prevented the inrush of energy that stripped the press gears and put the equipment out of commission until new parts could be expressed from the press makers.

Consider that A 1 is the armature, F 1 and F 2 the field magnets of the main driving motor, A 2 the armature, and F 3 and F 4 the field magnets of the auxiliary motor for slow speeds.

When ready to move the press ahead, close the service switch S S on the line and the small switch S in the jaw J 2, and move the arm H slowly to the right. When brushes C 1 and C 2 touch on dials D 1 and D 2 the field magnets of both motors will be excited. The field circuit of the main motor connects with one side of the line L 2 at O 1 and is made up of field magnets F 2 and F 1, wire W 1, controller dial D 1, controller brush C 1 and wire W 2, which connects with the other side of the line L 1 at O 3. The field circuit of the small motor takes a similar course, but uses dial D 2 and controller brush C 2. Next, the small motor armature circuit closes in the controller as C 4 touches point 1 on dial D 4. Later, C 6 touches D 7, exciting contactor K 2, making the final close at R 2 in the armature circuit of the small motor, when it should turn slowly. The small armature circuit leaves line L 2 at O 2, and is formed of brush B 3, armature A 2, brush B 4, wire W 3, magnetic blowout coil T 2, contactor make and break R 2, a second portion of wire W 3, dial and part of resistance D 4, controller brush C 4, then by means of wire W 2, it is connected to line L 1 at O 3. When C 4 passes onto point 4, dial D 4, the resistance will be out of circuit with armature A 2, and the small motor will run at maximum speed, the press and large motor at a very low speed.

When ready for press production, continue to move arm H to the right, when C 3 should make good contact with point 1, dial D 3, closing the armature circuit of A 1 in the controller before brush C 5 touches D 5 and D 6. The instant that wire W 5 is closed at C 5, and D 6, the contactor is excited and makes the final close in the circuit of armature A 1 at R 1, when the large motor will develop

torque, and drive the press at an increased speed, letting the small motor run free. During the travel of the arm H to the right, resistance will be cut in circuit with armature A 2 and out of circuit with A 1, the result being that the press will come to production speed and when C 6 leaves D 7 contactor K 2 will open at R 2; current will cease to pass through armature A 2, which, being connected to the press shaft or large motor shaft by a ratchet drive, will come to rest. The large motor armature circuit leaves line L 2 at O 4, passes through brush B 1, armature A 1, brush B 2, wire W 4, magnetic blowout coil T 1, contactor make and break at R 1, a second section of W 4, dial and resistance D 3, controller brush C 3 and wire W 2 to line L 1 at O 3.

The contactor is a type of automatic switch, which can be employed in a web printing-press equipment to advantage, especially where hand control is used.

If properly constructed and provided with magnetic blowout T 1, it will make and break the main current in a manner to prevent destructive arcing. It will provide a no-voltage release and can be operated by remote push-buttons to move the press slowly for make-ready and threading.

The exciting circuit W 5 of contactor K 1 leaves line L 2 at O 5, passes through push-button P 2 and P 3 coil of K 1, a second section of wire W 5 to D 6 and by means of C 5 and wire W 2 is connected with the line L 1 at O 3. This contactor provides a no-voltage release, and for this purpose is supplied with an auxiliary controller circuit leaving W 5 at X, and when the plunger is up in K 1, it passes through I, and by means of wire W 6 is connected with D 5.

As the controller arm H moves to the right, brush C 5 leaves D 6 before the motor comes to speed, and the arm is let rest, but the contactor K 1 is kept closed by its second controller circuit W 6. If the current should be cut off the line while running for production, the contactor K 1 would open both the main armature circuit at R 1 and the auxiliary contactor exciting circuit at I, as the plunger fell for want of excitation.

When the normal voltage of the system is returned, the main exciting circuit of K 1 will be open at D 6 and its auxiliary exciting circuit at I. Since no current can pass through the exciting coil it will not close the armature circuit of A 1 at R 1, and the arm H will have to be moved toward the left or off position until C 4 touches point 7, dial D 4, and C 6 touches D 7, starting the small motor, and later when C 5 touches D 6, the starting resistance of the large motor will again be in circuit to allow the large driver to commence furnishing torque under the proper conditions.

The press should be piped for four small wires and provided with outlets at convenient places for push-buttons. One circuit, placed in this pipe and supplied with push-buttons P 2 and P 3, and looped into the coil winding of K 1, will allow the exciting circuit of this contactor to be opened from convenient points by the pressman, and the press stopped while running for production. A second circuit, placed in the pipe and supplied with buttons like P 1, and looped into the coil circuit of K 2, will provide remote control for slowly moving the press.

During repairing or threading paper the press can be moved without a man stationed at the controller H. When the switch S is closed on jaw J 1, the contactor K 2 can be excited, independently of the controller arm, by the use of the button P 1 and the auxiliary circuit W 8, leaving W 7 at the switch S and passing to line L 1 by way of W 2 without going through D 7. When this remote control is desired, the controller arm is moved to the right until C 4 rests on point 1 or 2 of dial D 4 and S is closed on J 1; then, when the open-circuit push-button P 1 is held down, the exciting coil of K 2 is closed across the line, causing R 2 to close and pass current to start the small motor on a portion of its armature resistance.

When the plunger in K 1 falls and opens the armature circuit of the large motor at R 1 it could be made to close part of a dynamic or other brake device. If a dynamic brake were used, it would not be allowable to have this plunger, when it moved down, make the final close in the dynamic or brake circuit across the armature terminals of A 1. It would be necessary to add an automatic brake switch, controlled by push-buttons, about the press, to be used to make the final close in the dynamic-brake circuit. This plan allows the stop-button to be pushed and the press stopped by simply cutting off the current and letting the press come to rest without using a brake. If a very quick stop is needed, after the button for cutting off the current is pushed, the brake-button, if held down, will apply the brake. An automatic switch for this purpose will have to be of a type that will open when the push-button is released.

Water-Power Development at Great Falls, Mont.

Plans are being perfected by Chas. T. Main, engineer, Boston, Mass., for the immediate development of two powers near Great Falls, Mont.

The upper development is to be made at the falls known as Coulter's, Crooked and Rainbow, situated about three miles down the river from Great Falls. At this point the head will be about 105 feet high. A crib dam about twenty-five feet high will be built with masonry head gate, and waste-gate structures. A steel penstock twenty-two feet in diameter and about 2,500 feet long will extend from the intake to the power house. The latter will be of masonry construction, containing about 30,000 horsepower of wheels and electrical apparatus.

The lower development is about twelve miles below Great Falls. Here the fall is about the same as at the upper development. The dam will be of the same construction as at Rainbow Falls, the canal being 500 feet long, and directly below this, the power house. The equipment will be a duplicate of that at the upper development.

The engineering corps, already organized by Mr. Main, is now busily engaged in making surveys and in the preparation of plans. The work on the coffer dams is already begun, and it is expected to push the work of development to completion as fast as possible.

A considerable portion of the power developed will be used at the Boston & Montana Smelter, at Great Falls, Mont. The balance will be transmitted to more distant places.

Engineers' Society of Milwaukee.

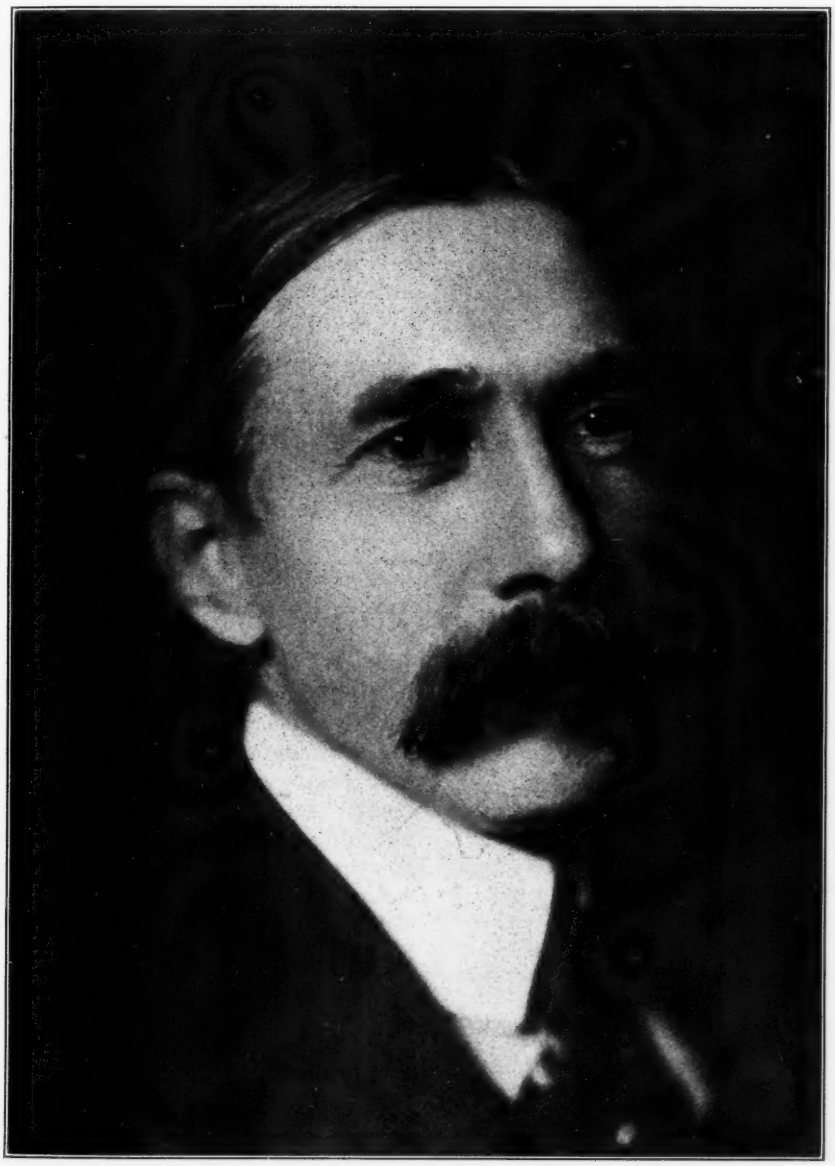
At the next monthly meeting of the Milwaukee Society of Engineers, which will be held on Wednesday evening, November 11, at the Builders' Club, 456 Broadway, Milwaukee, Wis., E. M. Griffith, state forester, will deliver an illustrated lecture upon "The Close Relation between the Forest Reserves and the Water Powers of Wisconsin." Besides discussing the general subjects of forestry and reforestation in their national and state aspects, the lecture will treat especially of the influence of forests in the regulation of stream flow, storage reservoirs, and waterpowers of Wisconsin. Invitations for the lecture may be obtained upon application to the secretary, W. Fay Martin, 456 Broadway, Milwaukee.

FREDERICK A. C. PERRINE.

BY RAY D. LILLIBRIDGE.

The death of Frederick A. C. Perrine, on October the twentieth at his home in Plainfield, N. J., after a protracted illness, has cut short one of the most promising careers in the engineering world, and one which is surpassed by few in actual accomplishment.

Dr. Perrine was of the highest type of young American engineer and man of affairs, and was a leader among the talented, earnest and well-trained men who have built up the standing of this country in applied science. He was born at Manalapan, N. J., in 1862, and received his education in that state, graduating from Princeton College in 1883, and receiving there subsequently the degrees of D. Sc. and A. M. A bent toward practical electricity resulted in his occupying positions of increasing responsibility in that field of engineering, then in the first stages of the wonderful expansion that it has undergone during the last three decades and to which Dr. Perrine contributed in an eminent degree. His distinguished career is, indeed, closely identified with the history of electrical engineering in this country. His work as chief engineer of the first great long-distance electric transmission line in this country—that of the Standard Electric Company of California—attracted attention the world over, and in recognition of this work he was awarded a gold medal by the Paris Exposition in 1900.



DR. FREDERICK A. C. PERRINE.

In addition to labors in important executive positions, like the presidency of the Stanley Electric Manufacturing Company, of Pittsfield, Mass., which he held from 1900 to 1905, he gave much of his best strength to a number of scientific and engineering societies, of which he was a member and for which he wrote many papers. He also devoted himself to technical editorial work, and to education—to the latter notably as professor of electrical engineering at Leland Stanford, Jr., University, from 1893 to 1900. He was also the author of a standard work on "Conductors for Electrical Distribution." For the last three years he had been devoting himself to consulting engineering, with offices in New York city.

Some of the societies of which Dr. Perrine was a member are the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the Institution of Electrical Engineers, of England. He was also a member of the Lawyers' and Engineers' clubs of New York city. In 1892 Dr. Perrine married Margaret Roebling, daughter of Ferdinand W. Roebling of Trenton, N. J., who, with their three children, survives him.

Pennsylvania Terminal Electrification Contract Let to Westinghouse Company.

Plans for the electrification of the Pennsylvania Railroad terminals in New York city have been announced with the signing of a $5,000,000 contract for the work with the Westinghouse Electric and Manufacturing Company. This action followed a meeting of the Pennsylvania directory in Philadelphia.

The contract is for the electrification of the entire Pennsylvania system from Harrison, N. J., to Jamaica, L. I. While the initial amount of apparatus will aggregate $5,000,000, this is said by no means to represent the full amount.

The Westinghouse company installed the 11,000-volt, twenty-five-cycle, single-phase system of the New York, New Haven & Hartford Railroad Company from Woodlawn, twelve miles from the Grand Central Station, to Stamford, Ct., and the award of the Pennsylvania contract to this company is to be taken as evidence that a similar double-catenary, single-phase trolley system will be used in the New Jersey, New York & Long Island electrification.

ALTERNATING CURRENTS AND THEIR APPLICATIONS.

BY EDSON R. WOLCOTT.

CHAPTER I. — (PART VI.) GENERAL PRINCIPLES. GRAPHICAL REPRESENTATION.

COMBINATION OF OHMIC RESISTANCE AND REACTION.

The ordinary or ohmic resistance of any of the coils just named cannot be added directly to the reactance to obtain the total opposition to the flow of current. The two can only be added as two forces are added that are acting on the same body at right angles to each other, as shown in Fig. 14.

Consider a body at A acted upon by two forces represented both in magnitude and direction by the lines A B and A D. The resultant, according to the parallelogram of forces, is represented both in magnitude and direction by the diagonal A C. Or, by geometry, the resultant A C can be expressed as follows:

$$A\,C = \sqrt{AB^2 + AD^2}$$

EXPRESSION FOR IMPEDANCE.

In a similar way the total opposition to the flow of an alternating current, that is, the impedance can be represented as the square root of the sum of the squares of the resistance and the reactance, thus:

$$Z = \sqrt{R^2 + X^2}$$

where Z represents the impedance, R the resistance and X the reactance; but since

$$X = 2\pi f L$$

on substituting,

$$Z = \sqrt{R^2 + (2\pi f L)^2}$$

or the current in such a circuit would equal

$$I = \frac{E}{\sqrt{R^2 + (2\pi f L)^2}}$$

It will be noticed from this expression that when L is zero the term $2\pi f L$ disappears and

$$I = \frac{E}{R}$$

which is the expression for the current in a direct-current circuit or in an alternating-current circuit when there is no inductance.

COMPONENTS OF ELECTRIC FORCE.

From the expression above it is evident that electromotive force E can be considered as made up of two components, thus:

$$E = I\sqrt{R^2 + (2\pi f L)^2}$$

or

$$E = \sqrt{R^2 I^2 + (2\pi f L)^2 I^2}$$

Note.—This serial was begun in the Western Electrician of October 3, 1908.

where R I is the ohmic potential drop and $(2\pi f L)$ I is the inductive drop. These two quantities can be represented graphically as two potential differences acting at right angles to each other just as the two forces were represented in Fig. 14. For example, in Fig. 15, let A C represent the ohmic drop I R, and B C represent the inductive drop $2\pi f L I$, then the line A B will represent E. As a concrete example, suppose I R equal 100 volts and $2\pi f L I$ equal 50 volts, then E would equal

$$\sqrt{100^2 + 50^2} = \text{about } 112 \text{ volts.}$$

Or the result can be obtained graphically from Fig. 15. If A C be drawn to represent 100 units and B C to represent 50 units, then A B will represent 112 units nearly.

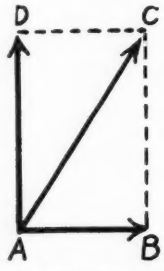


FIG. 14.—PARALLELOGRAM OF FORCES.

Suppose that under the above conditions a current of 10 amperes was flowing; then, since

$$I\,R = 100 \text{ volts,}$$

R would equal 10 ohms, and since

$$2\pi f L I = 50 \text{ volts,}$$

the reactance $2\pi f L$ would equal 5 ohms. If the frequency, f, is 60 cycles per second, then

$$L = \left[\frac{5}{2\pi 60}\right] = \left[\frac{5}{377.04}\right] = .0132 \text{ henry.}$$

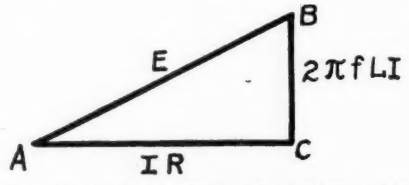


FIG. 15.—GRAPHIC REPRESENTATION OF ELECTROMOTIVE FORCES.

CALCULATION OF INDUCTANCE.

In other words, if an alternating current having an electromotive force of 112 volts and a frequency of 60 cycles per second be applied to a coil having a resistance of 10 ohms and an inductance of 0.0132 henry, a current of 10 amperes will flow.

It will be noticed that the inductance of a coil can be determined in a manner similar to the above calculation. On passing a direct current of 112 volts through the above coil a current of 11.2 amperes will be obtained, showing that the resistance R is equal to 10 ohms. With an alternating current, if the value of the current is 10 amperes, then the total expression is

$$I = \frac{E}{\sqrt{R^2 + (2\pi f L)^2}}$$

or

$$10 = \frac{112}{\sqrt{10^2 + (377\,L)^2}}$$

or

$$112^2 = 100 \quad 10^2 + (377\,L)^2$$

or

$$25.44 = (377\,L)^2$$

or

$$L = 0.0132 \text{ henry.}$$

It is to be understood that the above formula is used because it expresses the conditions that lead to a result corresponding to that obtained by experiment. It is similar in appearance to a formula expressing the resultant of two forces acting on the same body at right angles to each other, as already stated. Now the question arises as to how it is that the ohmic or non-inductive drop and the inductive drop can be considered as acting at right angles to each other?

CURVES OF COMPONENT ELECTROMOTIVE FORCES.

Suppose an alternating electromotive force is flowing through a straight conductor in the manner illustrated in Fig. 16 by the curve O B C D. There will then be no appreciable inductive effect. Let the straight conductor now be coiled and iron inserted in the coil, an induced electromotive force will appear in the coil itself, being that generated by the magnetic field when its energy reappears in the wire as an electric current as already explained. This induced electromotive force, as has been found by experiment, reaches a maximum when the current producing it is making its most sudden change, which is at the point when it is changing from a current in one direction to a current in the opposite direction.

The current curve is represented by the dotted line in Fig. 16. It passes through a zero value at the point C, and therefore this will be the point at which the induced electromotive force will reach a maximum, as shown on the curve M N P Q, which represents the curve of the induced electromotive force, or the inductive drop.

Let the curve O B C D represent the non-inductive drop or the electrical pressure that is forcing the current, represented by the dotted line, through the wire. The

resultant of the inductive and the non-inductive drop is the electromotive force which must be applied to the coil to generate the current indicated by the dotted curve. It is found by adding the instantaneous values of the curves O B C D and M N P Q.

Subtracting the length 1-3 from the length 1-2, because they are in opposite directions, gives the point 1, which is on the O X axis, since the two are equal; likewise 4-5 added to 4-6 gives the point T, which is the maximum value of the new curve; 7-8 added to 7-8 gives the point W, and so on.

APPLIED ELECTROMOTIVE FORCE.

The curve 1 T S therefore represents the combined effects of O B C D and M N P Q, that is, the applied electromotive force, or, vice versa, if an electromotive force such as is represented by the curve 1 T S is applied to an inductive circuit such that the induced electromotive force is represented by the curve M N P Q, then, the active electromotive force will be represented by O B C D and the current by the dotted line.

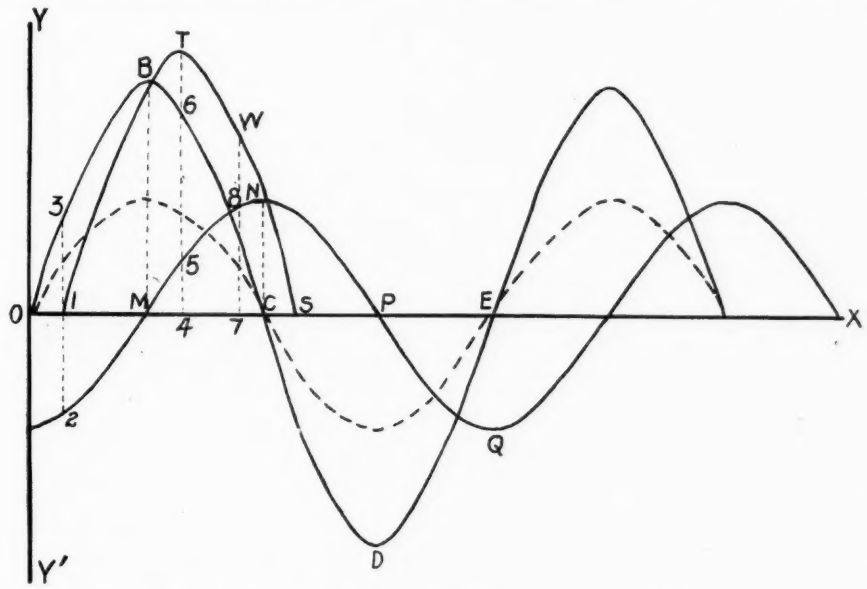


FIG. 16.—CURVES OF ELECTROMOTIVE FORCE AND CURRENT.

PHASE.

Three hundred and sixty degrees represent a complete cycle, so that the distance O E represents the time of a complete cycle, O C that of a half cycle, and O M or M C that of a quarter cycle, or 90°. The two electromotive forces O B C D and M N P Q reach a maximum one quarter of a cycle out of step with each other and are said to be 90° out of phase with each other. Representing the effective values of all of these curves by lines, a triangle similar to that of Fig. 15 is obtained. Since M N P Q is 90° out of phase with O B C D, the effective value of the latter will be represented by a line at right angles to that representing the former. It will be noticed that the applied electromotive force as represented by the curve 1 T S is out of phase with the current curve, which is represented by the dotted line. The distance 0 1 is about three-tenths of the distance O M, which represents a quarter cycle, or 90°. The two curves are therefore three-tenths of 90°, or 27 degrees out of phase with each other. The current and applied electromotive force are always out of phase in an inductive circuit.

There is a mechanical analogy to this: A pendulum may be oscillating to and fro and another oscillatory motion may be applied at right angles to the first, whereupon the pendulum will then execute a motion which is the resultant of the two.

[*To be continued.*]

Electricity Direct from Coal.

In a paper on "The Scientific Control of Fuel Consumption," read on September 29 before the Iron and Steel Institute, H. E. Armstrong, professor of chemistry in the City and Guilds of London Central Technical College, made some interesting observations concerning the direct conversion of the energy latent in fuel into electrical energy. He remarked that to say that this was impossible would be absurd; it was useless to exaggerate the difficulties. Hydrogen can be burned electrically in the Grove gas battery, but there is no economical process of preparing hydrogen; it can, however, be obtained by passing steam over red-hot coal, but only in admixture with carbonic oxide. "Why not burn such a mixture electrically?" it may be asked. Strange to say, not only are we unable to substitute carbonic oxide for hydrogen in a gas battery, but it puts a stop to hydrogen being used in one if mixed with it. Why this difference should obtain between the two gases, both being combustible, we scarcely know, although we may guess at the reason. Why carbonic oxide should hinder the electrolytic oxidation of hydrogen at present entirely passes comprehension. It is problems such as these, said Professor Armstrong, that we need to solve before any substantial advance can be made. No one, he continued, has yet succeeded in making a satisfactory voltaic battery with carbon, and before coal is burned electrically it will certainly be necessary to make it a conductor of electricity. "All these are tasks which we should aim at executing, whatever the difficulties in the way, the solution of such problems being of infinite importance to mankind."

Probable Earnings of the Hudson Tunnels.

In an estimate, submitted to W. G. Oakman, president of the Hudson Companies, by W. G. McAdoo, president of the Hudson & Manhattan Railroad Company, the probable earnings of the system are indicated as follows: Total net per annum, $3,810,000; fixed charges, $2,657,500; surplus, $1,152,000. Mr. McAdoo's figures are as follows:

77,000,000 passengers per annum (estimate of C. M. Jacobs, chief engineer, and Hugh Hazelton, electrical engineer) at 5 cents per passenger	$3,850,000
Cost of operation and taxes, at forty per cent (estimate of Hugh Hazelton, electrical engineer)	1,540,000
Net earnings from passenger traffic	$2,310,000
Net income from Terminal Buildings	1,200,000
Estimated income from baggage, advertising in cars and stations, news stands and other privileges, per annum	300,000
Total per annum	$3,810,000
Deductions from income:	
Interest on $53,500,000 Hudson & Manhattan Railroad first mortgage 4½'s (this amount estimated to be outstanding on completion of the lines) and $5,000,000 New York & Jersey Railroad 5's	2,657,500
Surplus	$1,152,500

ILLINOIS STATE ELECTRIC ASSOCIATION.

ANNUAL CONVENTION AT BLOOMINGTON, ILL., OCTOBER 27-28.

The Illinois State Electric Association held its annual convention at the Illinois Hotel at Bloomington, Ill., on October 27 and 28. In point of numbers of members attending and the character of papers presented, it was the best convention that has been held by the association. Special interest was shown in all the papers that were read because they had been printed before the convention met and then distributed to the members so that they were able to follow the speaker better. The weather the first day was disagreeable, but the second day turned out as fine as could be wished for. On the first day sixty-eight delegates had been registered.

President E. L. Brown of Elmwood called the convention to order on Tuesday morning, and in his address called attention to the loss of Senator John N. C. Shumway, former president of the association, who died during the past year. He also referred to the paper read before the National Electric Light Association by Mr. Doherty as to the advisability of the state organizations becoming part of the National Electric Light Association, by dropping their own name and becoming geographical parts of the national body. Speaking of governmental regulation of public utilities President Brown said: "It is easily apparent that regulation should come through the highest source possible, presumably a state board, as is in satisfactory operation in Massachusetts, Wisconsin and New York. Authority that would be removed from petty prejudice to the plane of the judicial, would have confidence of our customers, and be unlikely to place confiscatory regulations upon us. To be placed at the mercy of uninformed and transitory local officials would mean instability, endless friction and be a menace to growth and enterprise."

The first paper presented was that of J. J. Frey of Hillsboro, on "How to Finance a Small Electric Station." In this paper the methods of management that cause the failure of many small plants were briefly touched on. The author then considered the question of a new public service law and the good that would come through the appointment of a public service commission. The use of a uniform system of accounting was strongly urged so that costs could be compared in detail for similar plants.

Mr. Edwin O. Brown of Elmwood followed with a paper on "Extending Electric Service to Neighboring Towns." He described extensions of the plant at Elmwood, with which he is connected, to the nearby towns of Yates City, Brimfield, Douglas and Magnon. The longest transmission line is twelve miles, 6,600 volts being used. The entire system is laid out with great economy and is operating very successfully.

The afternoon session was opened by E. L. Smith, of Kewanee, who read his paper on "Elements of Cost of Service to the Consumer." He said that the subject was not given the attention that it deserved and that too many managers of small plants were in the habit of taking the coal cost as the cost of current. This was the case where the cost was given sometimes as only 1¼ cents per kilowatt-hour. He then gave a long list of items for both operation and maintenance that should be considered in making up the cost of the current, and the way that they might be classified so as to get the cost at the switchboard and the final cost to the consumer.

"The Advisability of Establishing a Day Circuit in the Small Town" was the subject of a paper by A. R. Manley of Mt. Carmel, who was unable to attend the convention. The paper was read by D. Davis of Litchfield. The paper was one of the best presented to the convention.

The author showed that the possibilities of the smaller localities are very frequently overlooked and neglected. While it is true that many electric light companies in the smaller towns have rather a precarious existence, this is due more to the companies themselves than to a lack of market for their product. Under anything like normal conditions, any town or city, large enough to have an electric light plant at all, can and will support a day circuit, if the opportunities for selling current are recognized and taken advantage of by the company. Most electric light plants, in towns having a population of 5,000 or under, operate either on a dark-to-midnight schedule, or, at the most on a dark-to-daylight basis. If a property remaining idle from twelve to eighteen hours of the day can be made to pay dividends, or even to meet its expenses, it would appear reasonable that, if an income could be obtained from the property during the full twenty-four hours, the profits would be much greater.

The fixed charges against the property and the depreciation are practically the same whether or not the day circuit is operated. The taxes, insurance, office expenses, etc., do not stop when the engines are shut down. The additional expenses of operating a day circuit are confined to the cost of fuel, supplies and an extra man or two. Briefly stated, all the income from the current sold in the daytime, over and above the cost of the extra fuel and supplies and the salary of the extra man or men, is profit.

All the conditions essential to the success of an electric-lighting plant are particularly so to one operating a day circuit. It is necessary to give continuous service, have a reasonable and fair rate and, most important of all, to have every service metered. It is advisable to give every patron on the lines the advantage of the day circuit—the opportunity to use current when he wants it. Under these conditions no flat-rate contract could be made that would be equitable to both consumer and central station, or that would not be abused.

Many helpful hints were given in the paper on how to bring the day service to the attention of the public and on how to conduct an aggressive campaign to further the introduction of motors, fans, signs, heating devices and all manner of electrical appliances for both industrial and household use. Reference was made to a plant whose load is practically the same summer and winter and after five years of constant advertising, constant solicitation, and which has brought the people to a point where electricity in the daytime has become a necessity and not a luxury. Every house that is built is wired and equipped, not only for lights, but for small heating appliances. The people are educated to a point where they apply for electricity for almost every purpose. The success of this plant is due largely to the fact that the service is absolutely dependable, the current not having been off the lines for more than four years. The rate is reasonable, averaging five cents for motor service and eight cents for lighting. The output has reached a point where the net profits from the day load are in excess of the profits from the night load.

During the discussion of Mr. Manley's paper the fact was brought out that, if it could be arranged so that the power user would take his maximum amount of power at a time when it would not interfere with the lighting load, or if he had what might be termed an off-peak load that could be handled without added cost as to

equipment, he would be a great revenue producer, and an added benefit to all concerned.

The longest paper presented to the convention was read by George W. Burton, of Danville, on "The Legal Status of Transmission Lines in Illinois." The questions of law relating to this subject in Illinois are in many respects new. In the paper there were outlined the legal steps to be taken in the construction of a transmission line from one municipality to another, considering the situation within and without the municipal corporate limits, on highways and over private property, and with and without relation to individual and corporate property rights. These were discussed in connection with railway, telephone, telegraph and other electrical interests. A number of forms for frontage consents, pole line rights and municipal ordinances were appended to the paper. These were drawn so as to benefit the company by avoiding suits for damages.

In the discussion the matter of securing the whole of the right-of-way before commencing to build the line was shown to be a very important item as, if this is neglected and then the line is partly in operation, the expense of completion may easily become too great, for the property owners then have the company in their power and can demand too great a consideration for the small part that is needed to complete the line. The matter of using concrete poles came up during this discussion and Mr. Chubbuck called upon Mr. Miller, of Marseilles, who has been making them for a large system. He said they were made in molds in thirty, forty, forty-five and fifty-foot lengths. After being finished they were floated down the canal on a barge. As a pole thirty feet long weighed one and a half tons hauling them was a serious matter, and that the best way to do, where the conditions were not as favorable to their handling as they were there, was to haul the gravel and cement to the place where the pole was to be used and make it on the spot. The objection to this was the fact that it took twenty-one days for a pole to dry thoroughly, and during this time it would have to be lying there undisturbed and the conditions might make this impossible. After making the poles the holes were dug and the poles set by the use of a derrick wagon. Poles as made by him had six rods embedded in the concrete, one at each corner and the others nearer the center. Tests were made on the poles to determine how much they would stand. A pole was placed six feet in the ground, a rope attached to its top and the top deflected three feet with no cracks, the pole returning to the original position without a permanent deflection. When deflected four feet, it cracked at the bottom on the edges. Another test was made by attaching a rope to the top and fastening its other end to a tree, while between the two was hung a bag containing a mass of iron; this was jiggled up and down without any harm to the pole except a few small cracks on the edges.

At the request of the convention the subject of these tests and other information concerning concrete poles will be prepared into a paper for the use of the association. As to cross-arms for concrete poles some speakers advocated a concrete arm made integral with the pole while others suggested an iron arm, which was decided not to be as good on account of the rusting. The cost of these poles was given as double the cost of wooden poles; a thirty-foot pole costs $7.50 and a fifty-foot pole $12.50. These costs would vary as the cost of material and labor would vary in different localities.

The question of calling a line carrying high-tension wires a high-tension line was brought up, and it was agreed that in the future it would be better to call them long-distance transmission lines, and try to avoid the use of the term high tension, as enough opposition has been made to these lines already by the communities through which they pass or through which it is desired to erect lines.

On Wednesday morning Mr. McCollough, who was chairman of the committee to take action on the death of former President Shumway, read a set of resolutions at the opening of the meeting, and they were adopted and ordered to be placed upon the records and a copy sent to the family of the deceased. Senator Shumway was a charter member of the association, and much of the good accomplished by the association was through his untiring efforts. A report was received from the committee on the change in the by-laws calling for a fourth vice-president and an assistant secretary. It was adopted.

R. S. Wallace, of the Peoria Gas and Electric Company, then read a paper on "Rates and Their Relation to the Cost of Manufacture." This was believed by many to be the best paper read before the convention, but as it was not finished in time it was not in print before the session. The author had charts made and placed upon the wall to illustrate his remarks.

In this paper Mr. Wallace discussed the entire subject of rates and described the different systems of differential charging, giving examples of each. The fixed and variable costs were analyzed and their bearing on the equity of the rates made clear. Sliding scale or discount-for-quantity rates were condemned. Flat rates for sign and window lighting were approved, but in general meter rates are preferable for variable service. The author's general conclusions were: That the charge for service rendered should bear some relation to the cost of rendering it. Straight meter rates cannot possibly approximate the cost of service. Differential rates have been held equitable and legal in many decisions, and should be required where the difference in the cost of supply exists. As public servants, we must not favor one at the expense of another; that we must not sell to one at less than cost and make good our loss by excessive profits from another. While fully realizing the importance of acquiring and retaining the approval and confidence of the public, we must not, for the sake of popularity, sacrifice the basic principles which we know are essential to success, because there is public demand for something else.

During the discussion of the paper the fact was brought out that one rate could not possibly be fair to all consumers, as there are always different conditions governing the use of current as to the time when the maximum demand occurs and length of time when used. Various members gave their experience as to the rates they were charging and what success they had in securing the business and holding it. That it was an advantage to all concerned to have more electric power used, as someone in the electrical field was sure to benefit by it, a case was cited of several large stone quarries that were induced to use electric power, and while they were not served by a central station, they might some time be persuaded to be so served, and then someone would benefit by it, but at the same they were using the power now, and hence they were an addition to the electrical industry.

After this discussion the convention went into executive session and elected the following officers:

F. M. Sinsabaugh, Carrollton, president.

E. G. Schmidt, Springfield, first vice-president; W. G. Austin, Effingham, sec-

ond vice-president; H. A. Foster, Fairbury, third vice-president; A. R. Manley, Mt. Carmel, fourth vice-president.

E. Macdonald, Lincoln, treasurer.

H. E. Chubbuck, Ottawa, secretary.

Chester A. Willoughby, Ottawa, assistant secretary.

Executive Committee: W. B. McKinley, E. G. Schmidt, J. F. Porter, F. J. Baker, E. L. Brown, and the president and secretary, ex officio.

The convention then adjourned. The location of the next convention will be determined by the executive committee at a meeting next June.

In the way of entertainment Tuesday evening was given over to social pleasures, various theater parties being made up and many old acquaintances renewed. On Wednesday afternoon the members and their friends took a car ride over the Illinois Traction Company's line to Peoria as the guests of that company.

There was present at the convention a small number of representatives of manufacturing and supply houses. Several members made the remark that as to the papers and the interest manifested it was the best convention they had attended, and also that they had been helped very much by attending, as all the papers were practical and helpful to their own properties.

Central Electric Railway Association.

A. L. Neereamer, secretary of the Central Electric Railway Association, announces that the next regular meeting of the association will be held at the Lima House, Lima, Ohio, November 19. The prospects for a large attendance and an interesting meeting are good. The Central Electric Traffic Association will hold its meeting at the same place the day preceding the regular meeting. On the latter occasion papers will be read on the following subjects: "Purification and Heating of Water for Feed for Boilers," by a representative of the Harrison Safety Boiler Works, Philadelphia, Pa. "Possibilities of Handling U. S. Mail and Compensation Paid by the Government," by G. M. Paxton, general manager Dayton & Troy Electric Railway Company, Tippecanoe City, Ohio. "The Claim Department," by Frank Talmadge, Columbus, Ohio. "Railroad Crossings," by W. C. Sparks, superintendent of tracks, Indiana Union Traction Company, Anderson, Ind.

Handling of Live Wires and Fire Streams.

On August 17, 1908, a meeting was held at Altoona, Pa., which was attended by officials and employes of the Pennsylvania Railroad to the number of about 200, at which instructions and demonstrations were given of (1) the method of, and the precautions to be exercised in, handling live wires, and (2) approved methods to be employed in resuscitation of those apparently dead from electric shock. In addition a series of tests was run to determine, for various voltages, the distance from live wires at which streams from fire hose and chemical extinguishers might be played on the same without injury to those handling the hose.

By reason of the increasing use of electricity along the lines of the Pennsylvania Railroad Company, it has become of great importance that employes have a better understanding of the personal hazard involved in the handling of live wires, so that the rescue and resuscitation of those suffering or who have suffered electric shock may not be delayed through ignorance or misconception. Lectures to employes on approved methods of resuscitation of those apparently dead from electric shock have been given in the past from time to time by the relief department, as a part of first-aid instruction. At such times brief instructions have been given on the recovery of bodies in contact with electric wires. It was decided, however, to go into more detail in this direction at the present time, before representatives of the various divisions, so that these representatives might in turn disseminate the information gained to employes under their charge.

A lecture and demonstrations on the methods to be used in resuscitation from electric shock was given in the forenoon on the above date by the local medical examiner, after which those present practiced the movements on each other to a considerable extent. In the afternoon, demonstrations of the proper methods of handling wires and playing of fire streams were carried out, suitable wires and apparatus having previously been erected for this purpose in a convenient location in the Altoona railroad yard.

HANDLING OF LIVE WIRES.

A pair of iron pliers, designed for use in cutting wires carrying high potential, was exhibited, and the essential features demanded were carefully pointed out. These consisted mainly in the insulation on the handles of the pliers, which is required so that no part of the hands or of the person manipulating them shall come in contact with any metal part of the pliers, which in turn comes into contact with the wire in the act of cutting. The insulated handles were of wood and were screwed securely onto the metal handles of the pliers, after which they were boiled in paraffine. The insulation was tested at 8,000 volts alternating, and successfully withstood this test. Equipped with these pliers, and standing upon a thin board, an operator cut several times a line which was lying on the ground carrying a potential of 2,300 volts—the other side of the wire being thoroughly grounded.

To illustrate methods which might be used to remove a wire from a body, in the event of pliers or other means of cutting the wire not being at hand, a coat was placed under the wire and held at either side by means of the sleeves; two persons are necessary for this maneuver. By this method the wire was raised from the ground, no effect being felt by the persons holding the coat, though the latter was somewhat damp.

EXPERIMENTS WITH FIRE STREAMS.

In order to determine definitely what hazard, if any, existed for firemen when they were compelled in line of duty to play water from fire streams on live wires at various potentials, arrangements were made so that circuits of 525, 2,300 and 4,600 volts, respectively, were available. The 525-volt line was a direct-current trolley wire connected to the lines of the Altoona & Logan Valley Electric Railway Company. The 2,300-volt and 4,600-volt lines were fed from alternating-current generators at the Altoona car shops. One side of each of these circuits was thoroughly grounded, and the fire stream played on the other side, which was suspended in the air and thoroughly insulated. A suitable voltmeter was connected between the nozzle and ground to enable the difference of potential between the nozzle and ground to be noted in each case. The following results were obtained, at the voltages specified below, in tests made the day previous to the general demonstration:

525-Volt Trolley Wire.
⅝-in. Nozzle.

Distance of Nozzle from Wire.	Potential between Nozzle and Ground.
7 ft. 5 in.	20 volts.
4 ft. 9 in.	38 volts.
3 ft. 7½ in.	60 volts.
2 ft. 2 in.	70 volts.
0 ft. 7½ in.	210 volts.

These results show that the nozzle may be handled without discomfort up to a

point betwen three and four feet from the wire when those holding the nozzle are standing on the ground. It may be carried much nearer without harm, but would probably cause some discomfort. If those holding the nozzle were standing on a ladder or were otherwise insulated from the ground, it would be quite safe to bring the nozzle to within a few inches of the wire.

2,050-Volt Line.
⅝-in. Nozzle.

Distance of Nozzle from Wire.	Potential between Nozzle and Ground.
6 ft. 6½ in.	Static
3 ft. 5½ in.	Static

4,100-Volt Line.
⅝-in. Nozzle.

Distance of Nozzle from Wire.	Potential between Nozzle and Ground.
6 ft. 6½ in.	Static
3 ft. 5½ in.	Static

In each of the above tests no measurable deflection could be obtained on the voltmeter, but upon touching the nozzle with the hand when standing on the ground a slight effect due to static electricity was noted.

The above results were obtained in tests conducted a day previous to the general demonstration. In this demonstration, however, results were obtained which agreed with these. These results follow:

525-Volt Trolley Wire.
⅝-in. Nozzle.

Distance of Nozzle from Wire.	Effect at Nozzle.
3 ft. 0 in.	Slight Indication to hand.

2,300-Volt Wire.
1-in. Nozzle.

Distance of Nozzle from Wire.	Effect at Nozzle.
8 ft. 0 in.	Slight indication of static electricity to hand.

4,600-Volt Wire.
1-in. Nozzle.

Distance of Nozzle from Wire.	Effect at Nozzle.
10 ft. 0 in.	Slight indication of static electricity to hand.

In each case the nozzle was sufficiently near the wire so as to cause a solid stream to play on the latter. Just how far the results of a fire-hose test with salt water will differ from those above, which were made with fresh water, cannot be said at the present time.

Experiments were also made with streams from hand chemical extinguishers, and it was found that when a solid stream is played on a high-potential wire it becomes a source of danger to one holding the extinguisher. For instance, the nozzle of an extinguisher was held at a distance of nine inches on a grounded 2,050-volt alternating line. The difference of potential between nozzle and ground was 1,500 volts when the extinguisher was insulated from the ground.—*R. H. Newbern, superintendent insurance department, Pennsylvania Railroad Company, in the Quarterly of the National Fire Protection Association.*

International Conference on Electrical Units and Standards.[1]

On Thursday, October 15, the Technical Committee devoted the first part of the morning to the specification of the mercury ohm. The draft specification prepared by the Reichsanstalt was taken as the basis, and after alteration read as follows:

"Specification A, relating to the Measurement of the Resistance of a Column of Mercury.—The glass tubes used for mercury standards of resistance must be made of a glass which is as free as possible from elastic after-effects. They must be well annealed and straight. The tube must be of circular cross-section or nearly so of approximately one square millimeter. The mercury must have a resistance of approximately one ohm. The tubes must be carefully calibrated along their length by using threads of mercury of different lengths. The calibration factor must not exceed 1.0005. The mercury filling the tube at zero degrees centigrade must be considered as bounded by plane surfaces placed in contact with the flat ends of the tube. The length of the axis of the tube, the mass of mercury it contains, and the electrical resistance of the mercury, are to be determined at a temperature as near to zero degrees centigrade as possible. The measurements, when made, to be corrected to zero degrees centigrade. For the purpose of these electrical measurements end vessels carrying connections for the current and potential terminals are to be fitted onto the tube. These end vessels are to be spherical in shape (of diameter of about four centimeters) and should have a cylindrical piece attached to make connection with the tubes. The edge of the tube is to be coincident with the inner surface of the spherical end vessels. The leads are to be of thin platinum wire fused into glass. The point of entry of the current lead and the end of the tube are to be opposite ends of a diameter of the bulb; the potential lead shall be midway between these two points. The leads connected to the platinum wires must be so thin that no error in the resistance is introduced through conduction of heat. The filling of the tube with mercury for the purpose of the resistance measurements must be carried out under the same conditions as the filling for the determination of the weight. The resistance which has to be added to the resistance of the tube to allow for the effect of the end vessels is to be calculated by the formula

$$A = \frac{0.80}{1{,}063\,\pi}\left(\frac{1}{r_1}+\frac{1}{r_2}\right) \text{ ohm},$$

where r_1 and r_2 are the radii in millimeters of the end sections of the bore of the tube. The mean of at least three fillings to be taken as the resistance of the tube. The mean result obtained from at least five tubes is to be taken as the mercury unit."

The final drafting of this specification was then referred to a drafting sub-committee, consisting of the chairman, Dr. Lindeck, Mr. Smith, and the secretary.

The committee then proceeded to consider Specification B for a standard silver voltameter. This was amended to read as follows:

"Specification B, relating to the Deposition of Silver.—The electrolyte should consist of from fifteen to twenty parts by weight of silver nitrate in 100 parts of distilled water. The solution may only be used once, and only for so long that not more than thirty per cent of the silver in the solution is deposited. The portion of the anode dipping into the liquid shall be of silver, and the cathode of platinum. The current density at the anode shall not exceed one-fifth of an ampere per square centimeter and at the cathode one-fiftieth of an ampere per square centimeter. Not less than 100 cubic centimeters of electrolyte shall be used in an experiment. Care must be taken that no particles which may become detached from the anode during electrolysis shall reach the cathode. Before weighing, any traces of solution adhering to the cathode should be removed, and the cathode itself dried."

This specification was then also referred to the drafting sub-committee, and the consideration of the specification of the Weston cell commenced. This was amended to read:

"Specification C, relating to the Standard Cell.—The cell to be taken as standard is the Weston normal cell, having an excess of stable cadmium sulphate ($CdSO_4 8/3H_2O$). The positive pole of the standard cell shall consist of mercury with mercurous sulphate as depolarizer;

[1] Electrical Engineer, London, October 23.

the negative pole to be of cadmium amalgam in the proportion of 12.5 parts by weight of cadmium to 100 parts amalgam. The electrolyte shall consist of an aqueous saturated solution of cadmium sulphate, neutral to congo red. The grains of mercurous sulphate must not be so small that an increase in the solubility and a consequent perceptible influence on the electromotive force may result; in addition, the solution from which the mercurous sulphate is precipitated must contain at least one-tenth gramme equivalent of strong acid; finally, the salt must be washed. The method to be employed must be one of those given in these notes, and the method must be closely followed. The depolarizer to consist of mercurous sulphate, mixed with powdered cadmium sulphate and a saturated, aqueous solution of this salt. For setting up the cell, the H form is the most suitable. The leads to the electrodes to be of platinum wire, which must not be allowed to come into contact with the electrolyte. The amalgam is placed into one limb after warming. The mercury is introduced into the other limb. The depolarizer is placed above the mercury, and a layer of cadmium sulphate crystals is introduced into each limb. The entire cell is filled with a saturated solution of cadmium sulphate, and then hermetically sealed. The following formula is recommended for the electromotive force of the cell in terms of the temperature:

$$Et = E_{20} - 0.0000406\ (t - 20°) - 0.00000095\ (t - 20°)^2 + 0.00000001\ (t - 20°)^3.$$

The value of the standard cell to be the mean of at least twenty cells, which must be intercompared at least every three months, and which must be checked at least every year against the silver voltameter. Cells differing from the mean by more than 1.10^{-4} volt are to be replaced by normal cells."

In the afternoon the discussion turned on the value of the international ampere. It was eventually decided that "should the conference accept the figure 1.11820 milligram for the electrochemical equivalent of silver, then the electromotive force of the Weston cell at twenty degrees centigrade be provisionally accepted at 1.01820 volts."

On Friday, October 16, the conference met again, and considered the interim report of the Technical Committee. The length of the mercury column for the international ohm was confirmed as 106.300 centimeters. After further discussion Resolution VI was accepted by twenty-one votes to three. This reads: "The international ampere is the unvarying electric current which, when passed through a solution of nitrate of silver in water, in accordance with the specification attached to these resolutions, deposits silver at the rate of 0.00111800 of a gram per second."

Resolution II, amended as follows, was passed by the same majority: "As a system of units representing the above and sufficiently near to them to be adopted for the purpose of electrical measurements and as a basis for legislation, the conference recommends the adoption of the international ohm, the international ampere, and the international volt defined according to the following definitions:"

An additional resolution, "That the ohm is the first primary unit," was passed unanimously.

The conference then proceeded to consider the steps necessary to secure uniformity of the standards in future.

Professor Warburg moved: "That the conference approves generally the draft scheme to establish a permanent commission to secure uniformity of administration in relation to electrical units and standards in the future. The conference refers the draft scheme to the Technical Committee to consider details and to nominate the first members of the commission." He then explained his views as to the ways for obtaining uniformity. He said that there were two courses open, one to form a central bureau like the Bureau des Poids et Mesures which kept the international meter, and the second was that given in the draft proposals.

Construction of Selenium Cells.

Selenium cells, which vary their resistance with the intensity of illumination to which they are subjected, may be constructed in a variety of ways. A common form, easily made, is to wrap two wires upon an insulating core, keeping them separated by a uniform short distance, and then coat over the wires with a thin film of molten selenium. Another plan is to cover the surface of some solid, usually glass, with a thin coating of selenium. A difficulty met with in doing this, especially with glass, is the liability of the selenium to form into drops, instead of adhering uniformly. A new method recently devised in Germany by W. S. Grippenberg, causes selenium vapor to condense on the cold surface of the glass. In this way very thin and uniform coatings which adhere well to the glass are obtainable. Two grooves are cut in the glass close together and of as great a length as possible, and these are coated inside with platinum to act as electrodes.

Changes in the Western Electric Company.

At a meeting of the board of directors of the Western Electric Company, held in Chicago, on October 30, the following changes among the officers were made: E. M. Barton retired as president and became chairman of the board of directors; H. B. Thayer was elected president; H. A. Halligan and F. R. Welles were elected vice-presidents; William P. Sidley was elected vice-president and general counsel; George C. Pratt was elected secretary.

Mr. Thayer has been vice-president for a number of years, and has been connected with the company for twenty-eight years. He was born at Northport, Vt., August 17, 1858, and was graduated from Dartmouth College with the A. B. degree in 1879. He is a director of the Tabulating Machine Company and the Mexican Telephone and Telegraph Company, a member of the New York Chamber of Commerce, the New England Society, and the University Club. Mr. Thayer has had his residence in New York city, and will continue to reside there, and some of the engineering and other administrative work of the company will be conducted at New York. This is for the purpose of avoiding duplication between the Chicago and New York offices and between the engineering department of the company and the telephone companies, its principal customers.

Mr. Halligan has been for a number of years secretary of the company and in charge of a large part of the American business. Mr. Welles has been connected with the company for more than thirty years, and has charge of the foreign business, residing in Paris. Mr. Sidley has been acting as counsel for the company, and will continue to so act. His office of vice-president will not involve severing his connection with the firm of Holt, Wheeler & Sidley, of which he has been a member for some years.

The Western Electric Company is engaged in consolidating its manufacturing business at its Hawthorne plant in Chicago. It is removing to that plant the manufacturing heretofore carried on at Clinton street, in Chicago, and the principal portion of that which has been conducted at its factory in New York city.

Recent Sources of Electric Light.

The ordinary carbon-filament incandescent lamp, says Dr. L. Block, in the *Journal fuer Gasbeleuchtung,* which has been greatly improved during the thirty years of its existence, consumes from three to three and one-half watts per candle-power. A considerable saving in current consumption is effected by the use of lamps with so-called metallized carbon filaments. By being subjected to a peculiar fusing process at high temperatures these filaments receive metallic properties, particularly that of increasing their resistance with rising temperatures. The saving in current is about thirty-three per cent as compared with ordinary incandescent lamps, as the metal-filament lamps consume only two to two and one-quarter watts per candlepower and have an equally long life. The methods of manufacturing these lamps were practically developed first in America and then by the Allgemeine Elektrizitäts Gesellschaft, of Berlin. Their cost is not appreciably higher than that of ordinary carbon-filament lamps. In historical sequence the Nernst lamp was the first of the new kinds of incandescent lamps. In this lamp a small rod, consisting principally of combinations of the metal zirconium, which does not conduct electricity when cold, is made conducting by the application of external heat, and then glows with an intense, almost pure white light as soon as the current flows through it. The Nernst lamp consumes from 1.5 to 1.7 watts per candlepower and has a life of about 400 hours. Its current consumption is fifty per cent less than that of the ordinary incandescent lamp. It is particularly suitable for higher tensions, about 220 volts. Competitors of the Nernst lamp are the more recent metallic-filament lamps, the first of which was the osmium lamp, invented by Auer von Welsbach. The filament consists of the metal osmium, which is very difficult to fuse, and is also very expensive. The lamps consume about 1.5 watts per candle, and their life is about 1,000 hours, without any diminution in lighting power during this time. However, the price of the lamps was very high. They could burn only in a vertical position and were made only for low tensions, so that on a 110-volt circuit at least three lamps had to be burned in series, and at least five on a 220-volt circuit. The later metallic-filament lamps have now taken the place of the osmium lamp. The next lamp of this kind was the tantalum lamp of the Siemens & Halske Company. The metal tantalum can be drawn into very thin and still strong filaments, those used in the lamps being over one-half meter in length and wound on a frame in the form of a cage. The energy consumption of this lamp is about 1.7 watts per candle and its life about 800 hours. At present it is made for pressures up to 120 volts and is particularly suitable for direct current. The latest successes in incandescent-lamp manufacture are the lamps with filaments made of wolfram and similar metals. They are now manufactured for the usual tensions up to 130 volts, in units of twenty-five to 100 candlepower, and are put on the market by various concerns under many names, such as osram, osmium, colloid, sirius, Just-wolfram, colloid-wolfram lamps, etc. Their principal advantage is the small consumption of energy of only about one watt per candle, which means a saving of seventy per cent over ordinary incandescent lamps and of forty per cent over Nernst and tantalum lamps. At the same time the lamps have a life of about 1,000 hours without showing any appreciable decrease in light intensity. They are equally well suited for direct and alternating current. The first lamps of this kind could be used only in a vertical position, but they are now able to burn in any position. Their price is at the present time still about three marks (seventy-five cents), but in view of the great saving in current this higher cost is scarcely to be considered. In the arc-lamp field a greater light intensity and economy were attained by the so-called flaming arc lamps. The carbons used in these lamps contain, inside of a coat of ordinary carbon, a core consisting chiefly of fluor in combination with various metals. The vapors of these metals glow in the electric arc with an intensely luminous flame of 1,000 to 2,000 candlepower. The energy consumption of these flaming arc lamps is only 0.2 to 0.25 watt per candle, and the carbons last from ten to twelve hours. The gases are removed from the lamps by natural circulation of the air, and for this reason they are not suitable for illuminating small or badly ventilated interior rooms. A still lower consumption of energy, 0.15 to 0.2 watt per candlepower, and an almost pure white light are obtained in ordinary arc lamps by the use of the new "Alba" carbons of Siemens Brothers. In conclusion, mention must be made of the peculiar mercury light, which was introduced first in America by Cooper Hewitt. This is an arc of unusual length produced in a vacuum tube between surfaces of mercury. It has a remarkable green color, its efficiency is about the same as that of ordinary arc lamps, but the life of the lamps is about 1,000 hours. The quartz lamp seems likely to find the most extensive application among this type of lamps. The arc is here produced in a tube of quartz, which is capable of withstanding very high temperatures, and consequently the arc may be confined to a much smaller space and the light efficiency increased about twice that of the ordinary arc lamp. It is used directly on 220-volt circuits and can be operated only by direct current, like others of this type. A quartz lamp of 3,000 candle-power was exhibited. In appearance it resembles the flaming arc lamp. It is suitable for all purposes where the color of the light, which is a greenish yellow, is immaterial, and where a strong and economical light is required. On account of its long life, which is about 1,000 hours, the attention is reduced to a minimum, and so far the quartz lamp must be considered the only long-lived illuminant of great intensity.

The Alternating-Current Railway Motors of the Oerlikon Company and Their Effects on Telephone Circuits.

A lecture, delivered by Dr. Hans Behn on this subject before the Physical Society, of Zurich, is reprinted in the *Elektrotechnische Zeitschrift* for September 24. The opening of the first alternating-current electric railway in Switzerland, that between Seebach and Wettingen, was subjected to a protracted delay on account of serious disturbances caused in the nearby telephone lines. The experiences and the means which led to the removal of the difficulty are reviewed in detail. A theory of special upper vibrations of the electromotive force produced in commutator motors was established, as well as also a theory and calculation of the effects of these vibrations on telephone circuits. Other favorable experiences made with this line are discussed, and principles for the construction of larger alternating-current motors on the Oerlikon system developed. A complete calculation for an electric locomotive of 3,600-horsepower capacity, with four motors, is given. The disturbing influences on the telephone lines disappeared with the employment of a current of fifteen periods per second, and motors operating under this frequency were adopted and are generally recommended for railroad operation.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

THE GRISSON RECTIFIER.

An improved type of this alternating-current rectifier, with aluminium electrodes, which was first brought out in 1903, is here described. The former glass cell has been replaced by an iron cell in order to permit air cooling in place of the original method of cooling by water, which proved impracticable. It has also been found of advantage to give the aluminium electrodes an inclined position, so as to permit an easy escape of the hydrogen bubbles. The electrolyte consists of a solution of specially prepared bicarbonate of soda in pure water in proportions of one to sixteen parts. The rectifiers are furnished with electrodes already formed, but they have to be "polarized" before being put in operation, that is, the aluminium electrodes have to be provided with a coating of oxygen bubbles. Tables of the operation of a rectifier on a 110-volt alternating-current circuit of fifty periods per second under varying loads indicate a maximum efficiency of seventy-five per cent, and of seventy per cent on a 120-volt, fifty-period, polyphase circuit. By connecting the cells in series or multiple they may be used for any tension or current intensity and adapted to any purpose.—*Abstracted and translated from Elektrotechnische Zeitschrift (Berlin), October* 1, 1908.

NEW ANTI-INDUCTIVE SYSTEM OF CROSSING AERIAL TELEPHONE CIRCUITS.

With the introduction of the first long-distance electric transmission lines, disturbing influences on telephone circuits in their proximity were observed. They manifested themselves by rattling noises in the telephone receiver, and were at first ascribed to electromagnetic induction, but it was soon ascertained that they were due rather to electrostatic induction. This can be easily demonstrated by entirely suppressing the current in the energy transmitting line and leaving it only under tension. But whatever the cause may be, the most effective way of preventing these noises consists in reducing the coefficient of mutual induction between the disturbing and disturbed nets to a minimum. This result is attained by twisting the wires of one of the two nets, preferably the telephone wires. With the insulated conductors of an underground cable this twisting presents no difficulty, but it is different with bare aerial wires supported on insulators. The efficacy of the method has been thoroughly demonstrated in practice, but the various ways of applying it had numerous defects. A new system has been adopted by the Northern Railway of

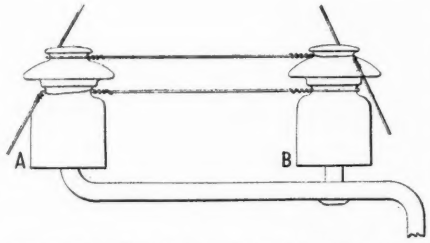


FIG. 1.—METHOD OF USING INSULATORS FOR TRANSPOSITION OF CONDUCTORS.

France, which was devised by its chief electrical engineer. In this system all the poles are uniformly provided with brackets carrying two insulators, as shown in Fig. 1. The insulators are of glass with a double bell and two recesses separated by a hood, the object of which is to insure perfect insulation between the two recesses. Fig. 2 shows the manner of put-

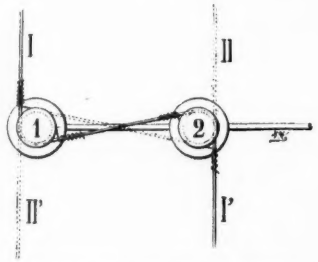


FIG. 2. METHOD OF USING INSULATORS FOR TRANSPOSITION OF CONDUCTORS.

ting the wires in place. Wire I makes a quarter turn in the lower recess of insulator No. 1, then goes to the corresponding recess of insulator No. 2 and passes on in the direction of I'. Wire II, represented by dotted lines, passes around insulator 1 and 2 in the same manner as wire I, but in the upper recesses. When the line has been put up, the conductors are held in place by binding wires. The effectiveness of this new crossing arrangement is evident, since it is only an artifice permitting a return to the original method. Double wire lines installed in this manner occupy space only in width and allow a utilization of the poles to their maximum capacity. The system has been tested for over a year on several long-distance telephone lines belonging to the Northern Railway Company of France, which frequently run parallel to high-tension transmission lines, and the results have been satisfactory in every way. The article concludes with a table indicating the number of crossings per kilometer which it has been found best to employ with different tensions and distances of the disturbing line.—*Abstracted and translated from L'Electricien (Paris), October* 10.

A RAILWAY ACCUMULATOR CAR.

Louis Dubois describes a new type of storage-battery car which has recently been put in operation upon the system of suburban lines around Mayence, under the direction of the Prussian Railroad Administration. A few cars of this design have been installed, and a favorable impression made. It is expected that a larger number will be called for in the near future. There are three suburban lines which branch out from Mayence and run as far as the towns of Oppenheim, eleven miles; Russelheim, seven and one-half miles, and Ingelheim, eleven miles, making a total of twenty-nine and one-half miles for the entire system. The present railroad is operated at speeds which vary between twenty and thirty miles an hour, and there are a number of intermediate stations on the route. The car is of the side-opening compartment type, and contains six compartments with seats on each side. The compartments are designed to hold ten persons each, and in general construction the car resembles the type which is used at present on the Berlin subways. The car is mounted on three axles of the ordinary kind without the use of bogies, and the over-all length between buffers is forty feet. The motorman's cab is raised considerably above the floor level, and there is a cab at each end of the car. The accumulators are stowed under the seats of the car in each of the compartments. The batteries are of an improved type brought out by the Accumulatoren Fabrik, of Hagen. Under each seat there are per-

manently placed two large boxes, which are protected by the front board of the seat, this being fixed by screws. The top of the seat is hinged and can be easily raised and held in this position by a catch when it is desired to inspect the battery connections. The two boxes contain seven and eight cells, respectively, making thirty in each compartment. The entire car holds 180 cells, which is found to be amply sufficient to run it under the present conditions of speed and gradient. The cells have a capacity of 2,300 ampere-hours at the 100-ampere discharge rate. With a single charge the 180-cell battery can cover a distance of thirty-six miles when running at a speed of twenty-four miles an hour, which is about the maximum speed used on the Mayence lines. With this capacity the car can make two trips to the suburbs and return without recharging. Upon returning to Mayence after the second trip the battery is charged in place by means of a flexible cable which is fitted into a charging plug at one end of the car. The battery is not removed except for making repairs. Each cell weighs 100 pounds complete. The positive and negative plates measure twelve by twelve inches, and have a thickness of about three-tenths of an inch. There are four positive plates per cell. The plates are separated by wood and gutta-percha strips, and are hung upon glass by lugs, leaving a space of about two and one-half inches under the plates. The cell boxes are of wood, which is specially treated and given an outer coating of acid-proof varnish. Connection is made to the terminals of each cell by means of a copper strip, which is, in turn, protected by a coating of lead. In order to keep the fumes out of the car, the top of the seat is provided with a rubber gasket, and the space under the seat is ventilated by a tube which projects from the car and gives a good supply of air to the interior. The 180 cells represent a total weight of about ten tons. They are able to furnish 68.5 kilowatts on a single discharge, as shown by official tests. Their energy capacity is 6.85 watt-hours per kilogram. The life of the positive plate is estimated at 62,500 car-miles, and that of the negative plate at 37,000 car-miles. On the front and rear axle twenty-five-horsepower motors are arranged for series-parallel control, with a gear ratio of one to 4.3. Eighty-four per cent efficiency is claimed with a total weight per motor of 2,600 pounds, including the gears and casing. The batteries may be charged in a single series of 180 cells, or in two groups of ninety cells coupled in parallel. The car, when fully loaded, weighs twenty-two tons. The motors weigh 2.4 tons, and the battery ten tons, making about thirty-five tons for the entire weight. The cost of the battery is $3,250, and that of the electric outfit $2,750. The car costs $750, making the total cost of the present outfit $6,750.—*Abstracted from the Electrician (London), October 16.*

AN ELECTRIC COLLIERY RAILWAY.

The electric railway at the Consett Iron Company's Chopwell colliery is interesting chiefly as being the first installation of its kind in the north of England. The innovation reflects great credit upon the company's mining engineer, F. O. Kirkup. The line connects the Chopwell colliery with a new winning at Whittonstall, about two and one-quarter miles distant. The coal at Whittonstall is loaded into tubs, which are made up into a train of thirty-six, and hauled by means of an electric locomotive to the screening plant at the Chopwell colliery. In this way the installation of a large amount of new and expensive stationary plant is avoided, and it is possible to work new isolated seams economically. The line is two and one-quarter miles long, with a maximum gradient against the load of one in twenty-four. The length of the maximum gradient is about 720 yards, and the average gradient against the load is about one in forty-seven. The load to be hauled, exclusive of the locomotive, is twenty-five tons; the time allowed for each journey ten and three-quarter minutes, and two double trips per hour are expected. The track is of twenty-six-inch gauge. For these conditions a powerful locomotive is necessary, and the narrowness of the gauge imposes severe restrictions on the motors. The body of the locomotive is supported on two bogie trucks, each equipped with a single fifty-six-horsepower, 500-volt Siemens railway motor. The aggregate capacity is 112 horsepower. The two axles of each bogie are connected together by side rods, in order to utilize the whole weight of the locomotive for adhesion. One of the axles is driven through spur gearing by the motor. This gear consists of two equal gear wheels and one pinion, the pinion being fixed on the motor axle, one gear wheel on an intermediate shaft, and one on the driven axle. The locomotive body is built up on two main longitudinal steel girders, which are themselves supported by cross beams from the bogie centers. The space between the bogies is utilized for the lower part of the driver's compartment. In this way the height of the locomotive is reduced, so that the line can be taken under a roadway without excessive excavation. Current is collected by two Siemens bow collectors of such a length as to allow of a considerable range in the height of the trolley wires. The track consists of fifty-pound Vignole rail. Each rail is thirty feet long, and they are bonded by means of a single bond at each joint. Power is supplied to the locomotive from a 200-kilowatt, direct-current, compound Siemens generator, coupled direct to a Belliss engine. The power house is situated about 600 yards from the railway, near the Chopwell end, and is connected to the overhead line by means of two positive and one negative insulated feeders running through earthenware pipes in a trench.—*Abstracted from Electrical Engineering (London), October 22.*

Civil Service Examination for Electrical Engineers and Draftsmen.—Office of Supervising Architect.

The United States Civil Service Commission announces an examination November 23 to 25, at the usual cities to fill a position of electrical engineer and draftsman in the office of the supervising architect, Treasury Department, Washington, D. C., at $1,200 per annum, and similar vacancies as they occur. The examination will be weighted as indicated: Mathematics to plane trigonometry, 10; theoretical and practical questions in electrical science (special reference to lighting and elevator work in public buildings), 20; drawing and design, 40; training and experience, 30. Three days of seven hours each will be allowed for the examination. Applicants should at once apply to the United States Civil Service Commission, Washington, D. C., for application form 1312.

Report of Earnings of the Northern Ohio Traction and Light Company.

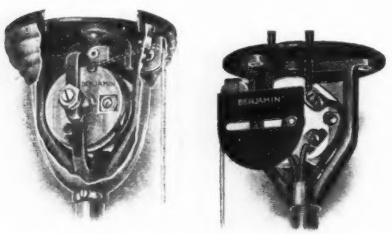
The report of the Northern Ohio Traction and Light Company for the nine months ended September 30 shows gross earnings of $1,421,549, against $1,459,782, net of $598,506, against $627,197 and surplus of $206,502, against $244,036. The earnings for October are estimated to be about the same as last year, and for the balance of the year will be able to show increases.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Some New Benjamin Specialties.

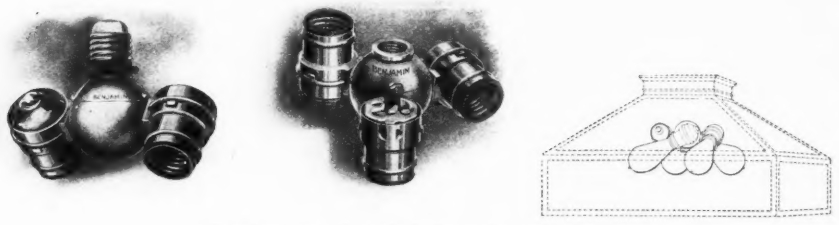
The Benjamin Electric Manufacturing Company, 42 West Jackson boulevard, Chicago, Ill., is placing on the market several new National Electrical Code Standard lighting specialties. The illustrations herewith show two grouping canopy switches with auxiliary pulleys. The Benjamin grouping canopy switch is



BENJAMIN GROUPING CANOPY SWITCHES.

adapted for conveniently and economically locating the control of any lighting fixture or bracket in which a plurality of lamps is to be operated in two groups. Two or three degrees of illumination may thus be secured without the necessity of running the usual three wires to the switches on the side walls or using two pendant switches. The controlling pendant cord or chain is dropped directly from the canopy, or it may be carried to any desired point by the use of an auxiliary pulley. Binding posts are provided in the switch for the two leading-in wires and the three other wires extending through the stem to the fixture body. The mechanism is substantial in character and is entirely enclosed. The canopy is provided with a fiber insulating ring. It has a margin of one-half-inch play to allow for projecting outlet boxes.

The illustrations herewith also show some new Benjamin adjustable plug and socket clusters designed for use with ceiling or pendant dome fixtures, stand lamps in dining rooms, reading rooms, or other installations, where it is desirable to adjust and fix the lights in special relation to the sides of the dome or reflector. The socket may be turned to any position between two points, 180 degrees apart, and locked by means of a screw. By removing the socket cap, easy access is gained to the binding screws. These clusters are easily wired, and are finished ordinarily in polished brass.



BENJAMIN ADJUSTABLE SOCKET CLUSTERS.

Curve-Drawing Instruments for Alternating and Direct-Current Circuits.

Curve-drawing instruments which will indicate the load conditions of central stations are a necessary addition to the modern switchboard. The General Electric Company has produced for this service a complete line of voltmeters, ammeters, single and polyphase wattmeters and power-factor indicators for alternating current, and ammeters, voltmeters and wattmeters for direct-current circuits.

As in all instruments for measurement, continued accuracy is the principal requirement, and its importance has been kept in view in the design of these instruments. Friction is almost entirely reduced to that of the recording pen on the paper. The moving element is entirely suspended by a steel piano wire, the lower end being accurately centered by a small hardened steel pivot passing through a ring-stone sapphire jewel. A device is also provided for holding the moving element and pen arm firmly in place during shipment.

The pen depends for its action upon the principle of capillary attraction. It has an iridium point sealed into a very small glass tube, which in turn is placed inside of a larger tube, the latter terminating in a bulb which holds sufficient ink to operate the pen seven days without refilling. The record is made on a band of specially prepared paper sixty feet in length. On this paper are ruled lines corresponding to the time and to the instrument calibration; ordinates across the paper indicating time and those ruled lengthwise representing volts, amperes, watts, power factor, or other quantity indicated by the instrument. This form of chart has the advantage of permitting the use of time divisions of equal length throughout the entire range of the recording pen. The recording pen is attached to the moving element in such a manner that its motion is transmitted in a straight line parallel to the time divisions on the chart, and the record or diagram thus produced is much easier of interpolation than that produced by instruments that have lines which are curved or of unequal length.

As the paper is unwound and passed under the recording pen, it is paid into a space at the bottom of the instrument case. The instrument case is provided with a cutter which enables the paper to be torn off evenly and without damage. When a roll of paper is exhausted the empty wooden holder can be easily removed by withdrawing it from the spring-supporting trunnions. A new roll can then be placed in position on the supporting trunnions, and the end of the paper carried over the idler roll at the back of the case. The pen arm is moved back from the paper by simply lifting it, which at the same time locks it into position, where it remains until loosened.

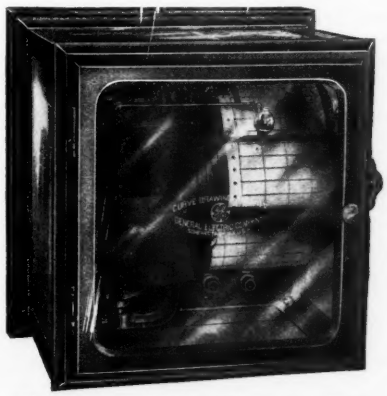
The standard rate of chart feed is three inches per hour, although a feed of one inch or six inches per hour can be furnished if desired. The rapid feeding of recording instrument charts is of great importance, as it insures a clear, accurate record that cannot be obtained with slow-moving charts. For driving the chart an eight-day clock, of simple and rigid construction, is used. It is self-contained, easily regulated and an accurate timekeeper. By means of suitable gearing, the clock drives a drum having peg teeth

which engage the holes located near the edge of the chart. These teeth not only feed the paper under the recording pen, but also give it a definite and accurate position along the axis of the drum. The feeding drum is driven by a friction clutch which can be operated either forward or backward. This enables the paper to be accurately located in regard to the time graduations without difficulty or without strain to the driving gears and clock. If desired, a re-roll attachment can be furnished with these instruments. By means of this device, the chart is rewound as it passes from the drum after the record has been made. The re-roll is revolved by means of a separate spring attachment, releasing the clock from any extra strain.

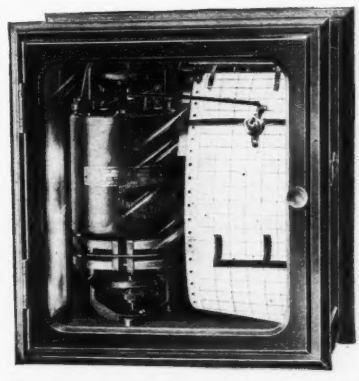
The electrical characteristics of these instruments are also excellent. The torque or directive force is very high, thus insuring long life with continued accuracy. The pen arm fluctuations are magnetically damped by means of a disk of aluminum passing between the poles of permanent magnets. This method of damping is very effective, introduces no friction, and is free from the objectionable features common to air or liquid damping systems. The instruments are thoroughly shielded from the influence of external magnetic fields. This desirable feature is accomplished by the use of a laminated soft-iron shell which completely surrounds the measuring coils. These instruments are free from heating errors and may be used on circuits of any wave form or power factor.

Ammeters, power-factor indicators and single-phase wattmeters are made in capacities up to and including 200 amperes and 650 volts, for use without current or potential transformers. For circuits in excess of the above, current and potential transformers must be used. Voltmeters are made in capacities up to and including 750 volts without potential transformers, which are required, however, above this limit. Polyphase wattmeters with current capacities up to and including sixty amperes and with potential capacities up to and incluuding 650 volts, are made for use without current and potential transformers. On circuits where the voltage and current exceed the above limits, current and potential transformers must be used.

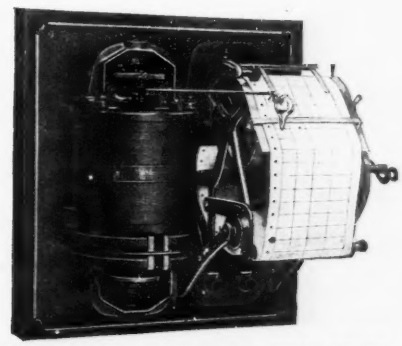
Direct-current curve-drawing ammeters are constructed upon the astatic principle, and are of the electromagnet type. The moving element consists of two rectangular-shaped coils connected together with two soft sheet-steel astatic control pieces fastened between them. The current to be measured, or a shunted portion of it, is passed through the coils, which are free to move in the field set up by two astatically arranged electromagnets. These magnets are wound standard for 125-250 and 550 volts, and the instruments are so designed that a twenty-five per cent variation above or below normal will cause no appreciable error in the instrument indications. The movement of the coils is opposed by the counter-torque of the astatic control pieces, and also by the control springs.



DIRECT-CURRENT CURVE-DRAWING AMMETER.



ALTERNATING-CURRENT CURVE-DRAWING WATTMETER.

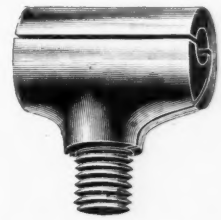


ALTERNATING-CURRENT CURVE-DRAWING WATTMETER WITH RE-ROLL ATTACHMENT.

Direct-current ammeters are made self-contained in capacities up to and including sixty amperes. Instruments with capacities from eighty to 3,000 amperes are provided with external shunts and can be furnished of higher capacities if desired. All of the shunts used with these instruments have a uniform drop of sixty millivolts, and capacities in excess of 800 amperes are provided with a special thermo-electric attachment, which is designed to eliminate errors due to thermo-electric currents. Both the alternating and direct current instruments are finished in dull black, and are enclosed in glass cases and fitted with felt guards or cushions to make them dust-proof.

Feed-in and Strain Support for Feeder Cables.

A new and improved combined feed-in and strain support for trolley feeder cables has been brought out by Dossert & Co., Incorporated, 242 West 41st street, New York. The device, as shown in the accompanying illustration, comprises a combination of the Dossert solderless cable

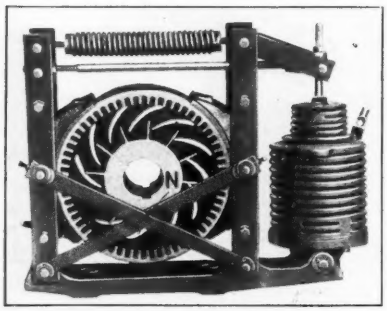


FEED-IN AND STRAIN SUPPORT FOR FEEDER CABLES.

tap with a regular soldered ear of the cap and cone type. The feed-in tap is made with a standard threaded stud which screws into the ear. A jamb-nut and lock-washer holds the feed-in tap securely in place against the boss of the ear. The advantages claimed for the Dossert feed-in are that it eliminates the process of soldering the feeder cable or fastening it with screws, gives contact throughout its entire length instead of at three points, as in case of a yoke, does away with bending and "checking" of the feeder by receiving it in a perfectly straight line, acts as a strain support, is strong and compact, and cannot work loose. The tap is bored to take up to No. 0000 round wire or stranded cable, and can be furnished with five-eighths-inch or three-fourths-inch stud.

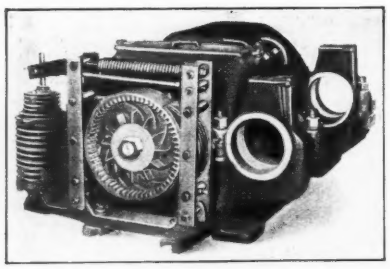
Electric-Motor Friction Brakes.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., has developed several types of electric-motor friction brakes for the many applications of motor drive where it is necessary to



REAR VIEW, TYPE SP BRAKE.

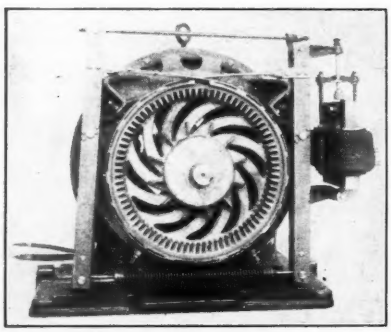
make quick and accurate stops. In rolling mills, blooming mills and similar installations, where frequent stops and reversals are necessary, brakes are needed to save time in bringing the motors to



TYPE SP BRAKE ATTACHED TO WESTINGHOUSE TYPE MD MILL MOTOR

rest before reversing, and to assist in the accuracy of control.

These brakes are built for both alternating and direct-current motors, and are operated by electromagnets, the coils of



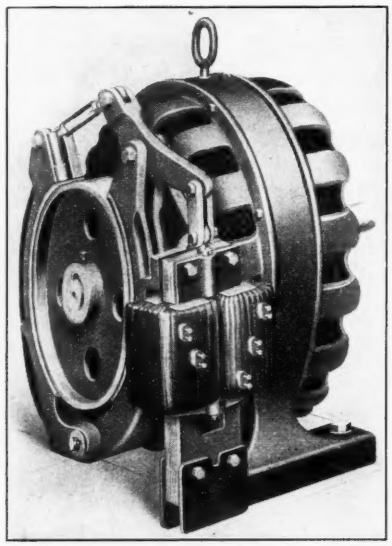
TYPE PB ALTERNATING-CURRENT MOTOR BRAKE.

which are connected in series or in shunt with the motor circuit. Series coils are used almost entirely with direct-current motors, and give more satisfactory service than shunt coils, although the latter can be supplied if desired. Alternating-current brakes are equipped with shunt coils only. These are connected across one phase of the motor circuit.

The type QK brakes are used on Westinghouse type K direct-current motors operating cranes, hoists, etc. These brakes are attached to the motors by means of special bearing housings carrying brake pads.

The type QBK brakes are similar to the type QK brakes in all respects, except that the former are mechanically operated, and are particularly adapted for use with the bridge travel motors of traveling cranes. These brakes are connected to the crane cage by suitable rods, and the braking force is applied by the crane operator.

The type SP brake has been designed primarily for steel-mill work, but can be



TYPE FS BRAKE ATTACHED TO WESTINGHOUSE TYPE HF MOTOR.

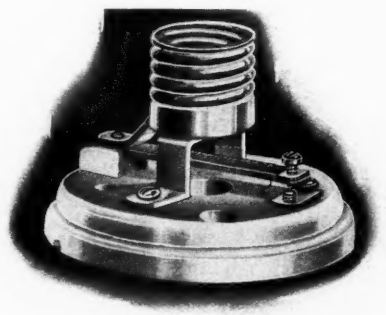
used in any service where a strong, rigid construction is desired. All parts are liberally proportioned, having a factor of safety large enough to meet the severest operating conditions. The brake is designed for mounting on the Westinghouse type MD mill motor, but can be used with other motors if desired.

The type FS alternating-current motor brake is adapted for twenty-five and sixty cycles, two and three-phase motor circuits.

Type PB alternating-current motor brakes are made for Westinghouse two and three-phase induction motors of from five to 100 horsepower, twenty-five, forty and sixty cycles. The braking action depends on the contraction of a coiled spring, and the brake will operate equally well with the motor tilted at a considerable angle from the horizontal position, as on roller lift drawbridges. This brake is attached to the motor in the same manner as the type FS, requiring a special bearing bracket and shaft.

A New Flashing Socket—the "Firefly."

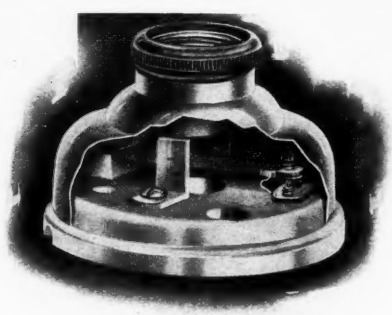
The reliability and usefulness of small thermostatic flashers, operating upon the principle invented by Dr. C. O. Schneider, of Chicago, about five years ago, has been



"FIREFLY" SOCKET FLASHER, SHOWING ARRANGEMENT OF PARTS.

amply demonstrated by the constantly increasing sales of the "Firefly" flasher, and also by the many cheap imitations of this simple little instrument that have appeared on the market at different times.

Realizing the desirability of a compact unit, containing both the flashing mechanism and a receptacle for the lamp, C. O. Schneider & Company have now devised



"FIREFLY" SOCKET FLASHER, WITH RING REMOVED.

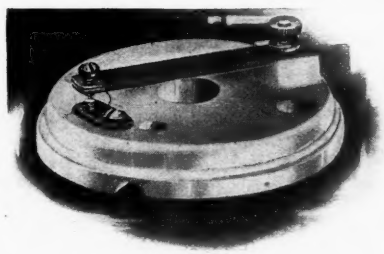
the "Firefly" flashing socket, which is illustrated herewith.

The flashing mechanism in the socket is the same as the regular "Firefly" only much reduced in size, and it operates equally as well as the larger instrument. The iridio-platinum contacts will be the same size as are being used in the original flasher, therefore they anticipate the same satisfactory long-lasting qualities of the new flashing sockets.

The flashing socket may be connected with the same facility as an ordinary

socket, it being merely necessary to unscrew the insulating ring, to lift off the cover, insert the wires through the porcelain base, fasten them to the binding screws and replace the cover and ring. Any lamp may be screwed into the socket, even up to a 100-candlepower tungsten. After waiting a minute until slightly warm, it will begin to flash the light on and off automatically from twenty to thirty times a minute, for a year or two.

Thermostatic flashers are now very extensively used to operate lamps in small electric signs, for attractive window-trimming effects, for displaying new types of lamp, decorative lighting, Christmas tree lamps, etc. In some forms of small signs made of all glass and metal, the flashing socket can be used without the ring and cover, as shown in the illustration. Another illustration shows the same flashing mechanism without the lamp socket; this will be known as the "Midget" flasher.



"FIREFLY" FLASHER USED WITHOUT RING AND SOCKET.

The great majority of thermostatic flashers in use at the present time are required to operate only a single lamp, and for this reason the flashing socket should meet an already existing large demand.

Schureman Alternating-current Elevator Controllers.

The J. L. Schureman Company, of Chicago, which for the past fourteen years has specialized in the design and construction of self-starters and elevator controllers, and whose direct-current apparatus is in general use throughout the country, has recently perfected a complete alternating-current line which is distinctive in that it conforms to the best principles in self-starter design, as developed in direct-current practice, by employing solenoids to perform all the functions of connecting the motor to the line and bringing it up to speed.

The line is complete in every respect and includes remote-control switches, self-starters for all classes of pump and compressor work, and elevator controllers for all services. Only one type, the reversing controller for slow-speed freight elevators, will be described at this time.

To obtain the best results and to avoid injury to the motor or controller through ignorance of the operator, the controller should be positive in action. After the rope has been pulled to start the elevator, the acceleration of the motor should be regulated entirely by the controller and should not be subject to the will of the operator. Also, in case of a failure in voltage through an interrupted circuit of any kind, it is unsafe to rely upon the judgment of the operator to return the controlling rope to the off position. To guard against accident in such a case the controller should be provided with a no-voltage release, which insures the return of the controller to starting position on failure of voltage.

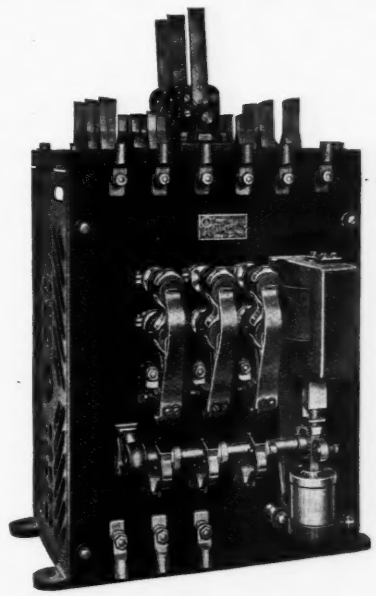
These controllers employ the resistance method of starting, and are especially adapted to slip-ring two or three-phase motors, such as are generally used for elevator service, on account of the high starting torque required. They have been successfully used, however, with squirrel-cage motors with high-resistance windings and comparatively high-torque characteristics.

The construction and operation of the controller is very nearly the same for either class of motor, the essential difference being in the rheostat. In the slip-ring type the starting resistance is of course inserted in the rotor circuit, is star-connected for three-phase motors and is inserted in all three phases. In the squirrel-cage type the resistance is inserted in two phases of the stator circuit and is cut out by the rheostat switches operating in pairs.

Fig. 1 shows a fifteen-horsepower, 220-volt, three-phase type "ASF" controller for a motor of this type. It is constructed along the same general lines as the "Schureman" direct-current freight elevator controller and consists of a solenoid-operated rheostat for accelerating the motor, and a knife-type reversing switch.

The method of operation is extremely simple. The shaft of the reversing switch is geared suitably to the operating mechanism of the elevator. A movement of the shipper rope sufficient to produce a throw of ninety degrees on the switch shaft closes the reversing switch and starts the motor in the direction for either up or down movement of the car, as desired, depending on the direction of pull on the rope, and the consequent direction of rotation of the switch shaft. This switch not only closes the stator circuit of the motor and connects the latter directly to the line, but also acts as a pole changer and controls the direction of rotation by reversing two legs of the stator circuit. It also controls the circuit of the rheostat solenoid, and when closed this solenoid is instantly energized and completes the operation of the controller by cutting out the starting resistance in the rotor circuit and bringing the motor to speed.

The construction of the controller is simple and rugged throughout, all parts being made interchangeable for easy replacement. The rheostat consists of a series of short-circuiting switches, a solenoid and dashpot. As the plunger of



FIFTEEN-HORSEPOWER, 220-VOLT TYPE ASF CONTROLLER.

the solenoid is raised, it revolves a horizontal shaft through the medium of a rack and pinion. A series of cranks placed at fixed positions on the shaft operate the switches, closing them in succession, and short-circuiting the starting resistance. The switches are three-point, and each short-circuits one step of resistance in each phase. In this way the resistance in each phase is equal at all times and the circuit is never unbalanced. This insures uniform torque and maximum efficiency. A vacuum dashpot retards the movement of the solenoid plunger and can be adjusted to give the desired rate of acceleration.

The solenoid is of special construction, the pull being practically constant throughout the stroke, and is practically noiseless in operation. It is designed to withstand severe service without undue heating.

Electrodeposition of Brass.

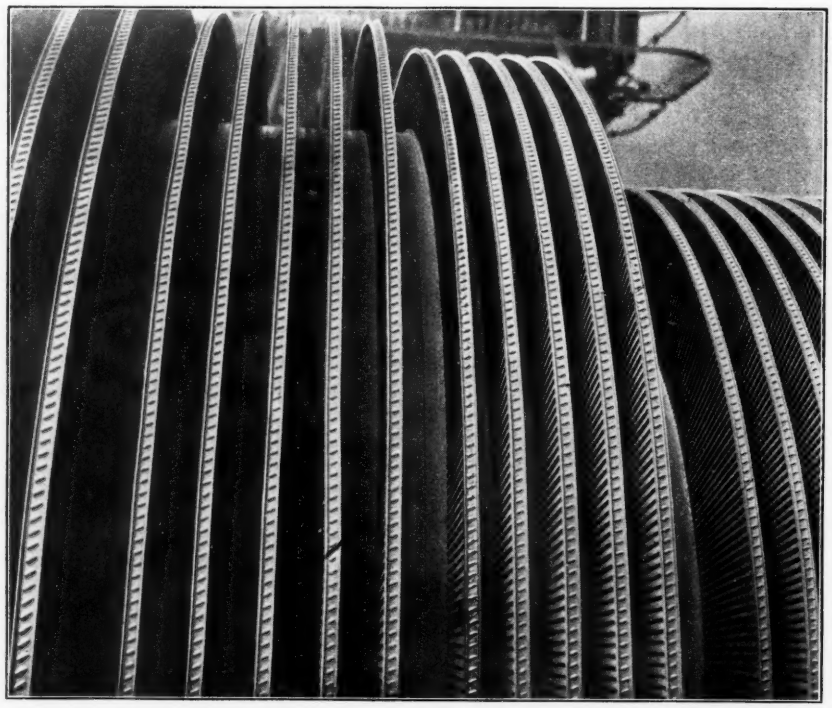
In the electrodeposition of brass and similar alloys the chief difficulty which has heretofore been experienced in practice is to obtain for any length of time an alloy of the desired composition. The composition of the alloy can be regulated within certain limits by varying the relative percentages of the metals in solution through the adjustment of the temperature of the electrolyte and the current density with the corresponding increase or decrease in voltage and moving the cathode, but this regulation is not sufficient in cases where it is desired to deposit an alloy of any thickness, for instance, to produce brass sheets or tubes.

As the result of an invention that was recently patented Mr. Sherard O. Cowper-Coles, of London, England, provides means whereby the composition of the alloy deposited can be more effectually controlled. His process consists in employing, in addition to an anode of the alloy to be deposited, say brass, anodes of copper and zinc which can be connected to the circuit which supplies the current passed through the brass anode. Furthermore, resistances are inserted in the conductors which convey the current to the zinc and copper anodes, whereby the amount of current flowing through these anodes, and as a consequence, the amount of metal that goes into the solution, can be regulated.

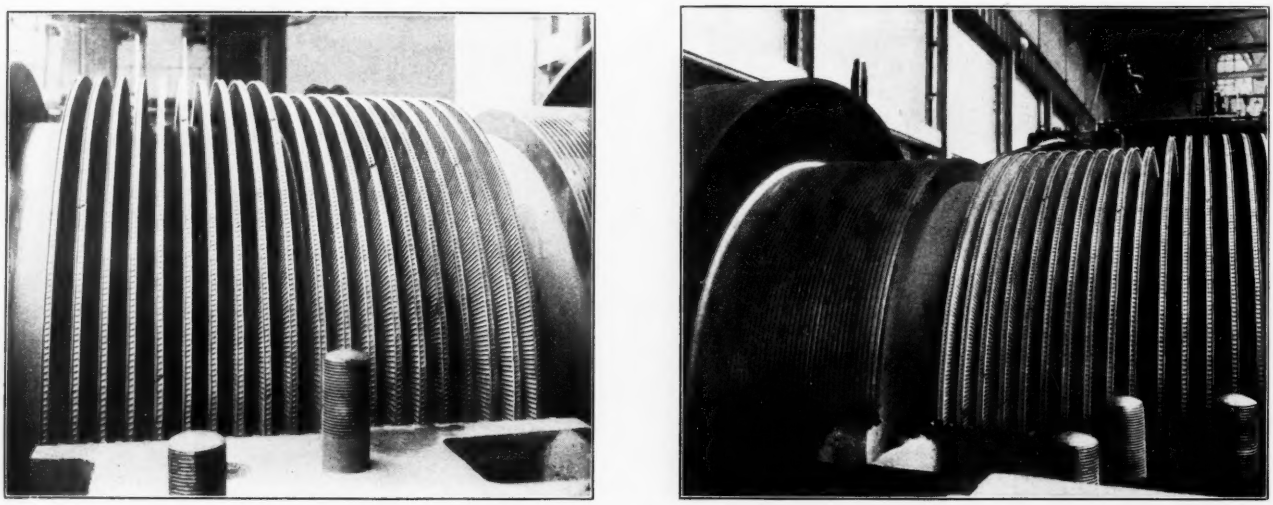
The inventor has found that good results can be obtained in practice with such an arrangement of anodes by employing an electrolyte composed of double cyanides of copper and zinc and potassium. He has obtained excellent results with an electrolyte prepared as follows: A ten per cent solution of cyanide of potassium is brought to the point of saturation by passing an electric current through a brass anode, the cathode being protected by a porous pot, and the electrolyte being then worked under the condition already mentioned, small quantities of cyanide of potassium being added from time to time to maintain the strength of the solution.

Remarkable Performance of Allis-Chalmers Steam Turbine.

The accompanying illustrations have been made from photographs which were taken of a 5,000-kilowatt Allis-Chalmers steam turbine which was opened up recently at the power house of the Brooklyn Edison Company, in Brooklyn, N. Y., after twenty-seven months' continuous service. The camera was brought as close to the machinery as practicable, in order to secure the greatest detail possible. The



A NEAR VIEW OF THE BLADING OF ALLIS-CHALMERS STEAM TURBINE AFTER TWENTY-SEVEN MONTHS' CONTINUOUS SERVICE.



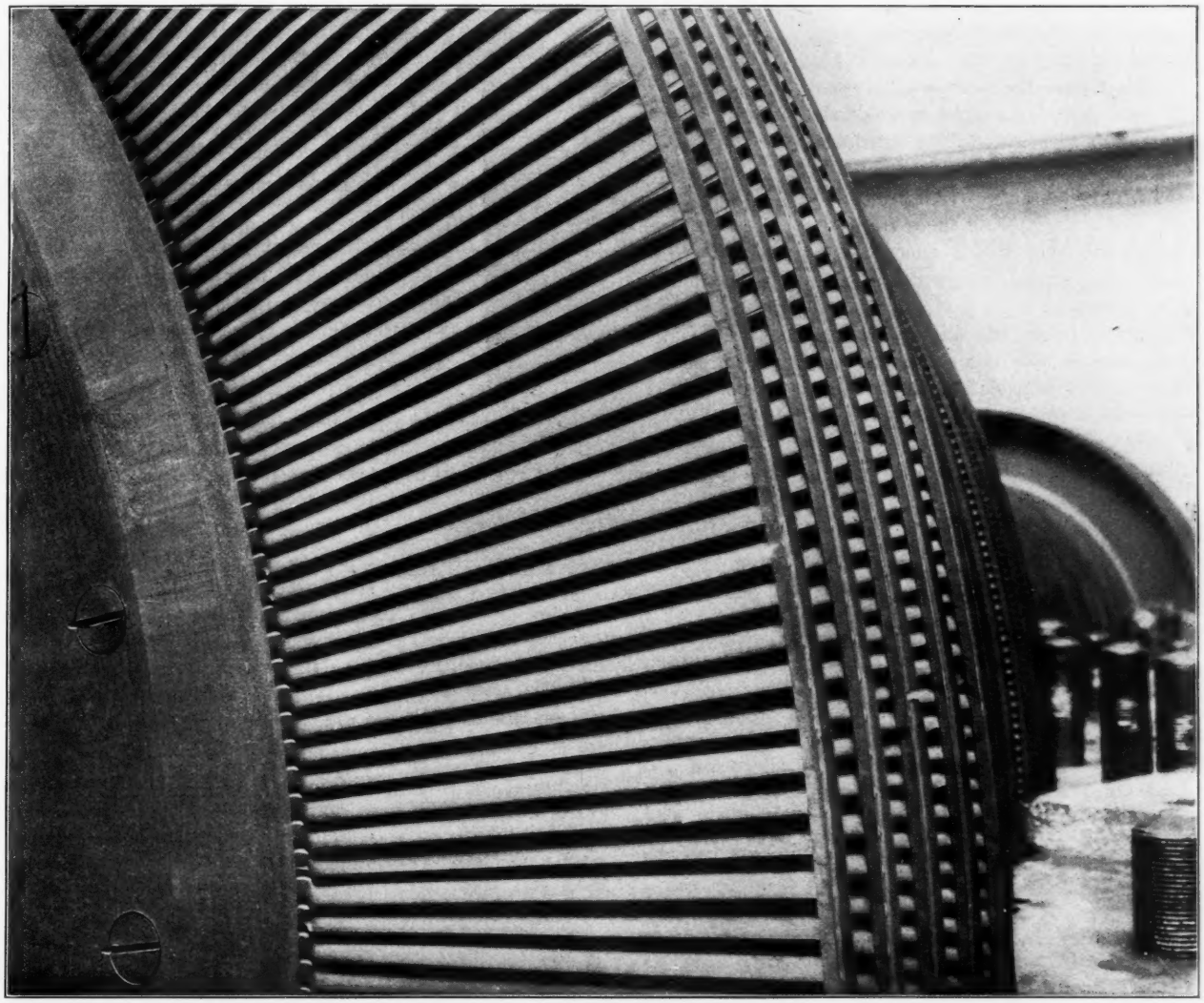
A 5,000-KILOWATT ALLIS-CHALMERS STEAM TURBINE AFTER TWENTY-SEVEN MONTHS' CONTINUOUS SERVICE IN THE POWER HOUSE OF THE BROOKLYN EDISON COMPANY, BROOKLYN, N. Y.

photographic results show that there was absolutely no deterioration after this long period of service. Notwithstanding the high initial rating given the machine, it has frequently carried a load of 9,000 kilowatts for long periods continuously.

The constructional features of the Allis-Chalmers steam turbine are well known, and they will be referred to here only briefly. The turbine as manufactured today is the result of practical experience and systematic experiment extending over the period since 1884, when the first commercial "Parsons" turbine was produced. The turbine consists essentially of a fixed casing or cylinder and a revolving spindle or drum. The ends of the spindle are extended in the form of a shaft carried in two bearings, and excepting the small parts of the governing mechanism and the oil pump, these bearings are the only rubbing parts in the entire turbine. Steam enters through a main throttle or regulating valve, and passes into the cylinder at the high-prssure end, passing alternately through stationary and revolving rows of blades, finally emerging at the lowest stage and passing to the condenser or to the atmosphere. Each row of blades, stationary and revolving, extends completely around the turbine, the steam flowing through the full annulus between the spindle and the cylinder. The blades in each step are arranged in groups of increasing length. At the beginning of each of the larger steps the blades are usually shorter than at the end of the preceding smaller step, the change being made in such a way that the correct relation of blade length to spindle diameter is secured.

Each blade is individually formed by special machine tools, and the roots of the blades are held firmly in the foundation ring. To protect and, in a substantial manner, bind together the tips of the blades, a shroud ring is used. Holes are punched in this shroud ring to receive projections on the tips of the blades, these holes being accurately spaced by special machinery to match the slots in the foundation ring. The finished rings themselves are of dovetailed shape in cross-section, and are inserted in dovetailed grooves in the turbine cylinder and spindle, respectively, in which they are firmly held by key pieces. The latter, after being driven into place, are upset into under-cut grooves, positively locking the whole structure together and making it wholly impossible for a blade to get out of place.

The flanges of the channel-shaped shroud rings are made thin, so that in case of contact from any accidental cause, no dangerous heating will take place, nor will the rubbing rip out the blades.



BLADING AND SHROUD RING OF 5,000-KILOWATT ALLIS-CHALMERS STEAM TURBINE AFTER TWENTY-SEVEN MONTHS' CONTINUOUS SERVICE IN THE POWER HOUSE OF THE BROOKLYN EDISON COMPANY, BROOKLYN, N. Y.

SILICO-VANADIUM TRANSFORMER STEEL.

BY H. W. YOUNG.

The remarkable magnetic qualities of the new silico-vanadium steel as used in recent designs of transformers has aroused so much inquiry that a brief discussion of the physical appearance of this alloy steel will be of interest.

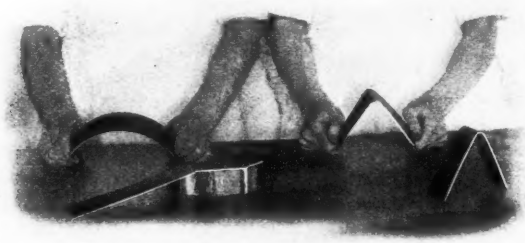
Silico-vanadium steel is strongly crystalline in structure, looking very much like a sheet of zinc or tin, although the appearance of different samples will vary on account of the different thicknesses of scale arising from the annealing process. When held so that the light is reflected from its surface this crystalline structure is most pronounced. Occasionally, samples will be found which are coated with a dark blue scale covering the surface of the metal, but when this is removed the characteristic crystalline structure is plainly discernible.

The susceptibility of silico-vanadium steel to oxidation during the annealing process is a very valuable commercial feature, for the reason that the exceedingly thin scale or film of oxide which forms on the surface is an insulator to the extent of rendering unnecessary the usual practice of painting or japanning the transformer laminations made from this steel. Insulating the laminations by paint or japan is not only expensive, but undesirable, for the reason that the japan or paint occupies some space, so that as much steel cannot be placed in a given section as would otherwise be employed.

In the accompanying illustration is shown a piece of silico-vanadium steel being bent into the form of a half circle, and also a piece of ordinary alloy steel, or silicon steel, which will not readily bend into the form of a half circle, but rather tends to form a V-shaped fold. The piece of silico-vanadium steel shown standing on edge has been bent sharply a number of times and shows how the dark blue scale has been loosened by the operation.

Anyone who is interested can thus readily compare the various alloy steels at present on the market by an examination of their physical appearance and also by the bending test, as shown in the illustration. A further peculiar characteristic of silico-vanadium steel is the manner in which it breaks and the appearance of the fracture. While there is a slight variation in the hardness of this steel, some pieces breaking instantly like glass upon the first attempt at bending, other samples may be bent very sharply several times before snapping. The fracture is irregular and the crystals may be easily seen without the aid of a magnifying glass.

COMPLETE SILICO-VANADIUM STEEL TRANSFORMER.



BENDING SILICO-VANADIUM STEEL.

As this subject is of such widespread interest at the present time, manufacturers have prepared small samples of the alloy steels which they are using, and are usually glad to send these on request.

The improved magnetic quality of silico-vanadium steel is now fully recognized as of great importance in decreasing transformer core losses, and improvements in efficiencies resulting are of material value to central stations. While the use of this new alloy has necessitated more or less redesigning the standard transformer, the general appearance has not been greatly changed, as will be noted from the illustration showing a complete transformer mounted in the case.

Texas Independent Telephone Convention.

Seventy-five representatives of Texas independent telephone companies attended the convention of the Texas Independent Telephone Association, held at Dallas, October 25 and 26. J. B. Earle of Waco, the retiring president of the association, delivered an interesting address in which he pointed out the benefits to be obtained by the members of the association through organized and concerted effort. C. A. Shock of Sherman, retiring secretary-treasurer, spoke of the value of a state association. The effect of anti-trust and anti-pass laws on telephone development was discussed by T. P. Stilwell of Lone Oak, who took the position that this character of legislation had encouraged telephone development in Texas. "Financing Telephone Properties" was the subject of a paper by W. A. Walker, president and general manager of the San Antonio Telephone Company. C. W. Emmer of Beaumont discussed the matter of "Relation of the Exchange Owner to the Supply Dealer and Manufacturer." Addresses were also delivered on the subjects: "How to Increase Income and Curtail Expenses," by E. M. Chamberlain of Greenville; "Rural Lines and Connections," by W. P. Johnson of Corsicana, and "Value of Tact in the Telephone Field," by Floyd R. Brown of Dallas.

The following officers were elected for the coming year: President, D. A. Walker of San Antonio; vice-presidents, E. M. Chamberlain of Greenville, R. A. Renfro of Hillsboro, and I. W. Parks of Giddings; secretary-treasurer, T. A. Gould of Ennis. D. A. Walker was elected delegate to the international convention, with J. B. Earle as alternate.

Current Electrical News

CONTINENTAL EUROPE.

BASEL, OCTOBER 17.—The city of Sofia, Bulgaria, whose population is estimated at 100,000, is well provided with electric lighting and tramways. To furnish the current for both purposes there have been erected two electric plants of some size. The first of these stations is a hydro-electric plant, about ten miles from the city, near the village of Pantcharevo, on the Isker River. The remainder of the power is supplied from a steam plant located within the city limits. The hydraulic plant uses a 170-foot head of water and has a capacity of about 1,600 kilowatts at present. Oerlikon alternators of the three-phase type are used in the station, and are direct-coupled to Piccard-Pictet wheels, manufactured at Geneva. In the second plant, within the city, are installed three units of 400 kilowatts each, arranged to be worked in parallel with the hydraulic plant, for both lighting and tramways. Owing to the extension of the tramway lines a new 1,000-horsepower group will be especially installed for this purpose. The lighting mains of the town are 3,400 volts on the primary and 150 volts on the secondary.

At the electrical exposition of Marseilles the section relating to traction contains some interesting electric railway exhibits. The Marseilles tramway company, which now operates one of the most extensive systems in Europe, shows a number of models of its city and suburban cars and motors. The Schneider Company of Creusot (France) has a complete exhibit of track material and rolling stock, together with many samples of fittings. Underground conduits for electric tramways are exhibited by the East Parisian Company. The Bordeaux Tramways Company has a large exhibit, which includes a train of three cars, two motor cars and a trailer, of the most recent type. A similar exhibit is made by the traction company of Nice, showing its multiple-unit cars. The Genoa company has two narrow-gauge traction cars, in which the electric outfit was furnished by the Allgemeine Elektrizitäts Gesellschaft of Berlin.

At Budweis, Austria, there is a project in consideration for a new system of narrow-gauge electric traction lines for the city. The International Electric Company is one of the promoters, and it is intended to run several different sections of line in the town and the suburbs. A new suburban tramway line, which was opened not long ago at Berlin, runs to the locality of Altstadt. Passengers and freight are carried on this line. The city of Basle, Switzerland, besides having extensive tramway lines within the town, is now the terminus of two suburban lines. One of these lines (the Birseck road) uses a type of motor car and trailer. The extensive electrical works of the Abott Company, one of the largest in Switzerland, are located on the present line at Münchenstein. The second suburban system, known as the Birgstal road, uses motor car trains.

At St. Petersburg not long since there was held a congress of the leading railroad officials of the county to discuss the question of adopting electric traction upon parts of the principal railroads of Russia. This move is an important one, as it is proposed to use the electric system upon the St. Petersburg-Moscow, Kharkoff-Sebastopol, St. Petersburg-Warsaw and Kieff-Odessa lines.

A. DE C.

GREAT BRITAIN.

LONDON, OCTOBER 16.—Just as there seemed to be a possibility of the London electric power bills being allowed to come before a committee of the House of Commons and being considered on their merits, the opposition of the London municipal authorities has assumed a most virulent form, and every effort is to be made to prevent the companies' bills going forward. Considerable strong feeling has been shown at the action of many members of Parliament for London assenting to the second reading of the bills, their reason being that they were convinced of the necessity for some bulk supply arrangements being made, and that as the London County Council had expressed its intention of not entering the field with a scheme, they voted for the companies' bills as the only alternative.

The delegates to the International Conference on Electrical Units and Standards are not lacking entertainment. Luncheons and dinners have been given by the government, and also by the Royal Society and the lord mayor of London, and visits are being made every day to numerous institutions, both scientific and popular.

Trolley omnibuses appear to be creating an impression among municipal tramway authorities. The latest giving consideration to their adoption are the Liverpool and Falmouth local authorities. Similarly, the London Electrobus Company continues to make applications to numerous provincial authorities for permission to run electric omnibuses in parts not touched by tramways.

Rumors are afloat in London of the formation of a new electric power company, with the sole object of supplying the Rand (South African) mines. Of interest in the same connection is the report of the Victoria Falls Power Company, which has just been issued. From this it is clear that the utilization of the waterpower at the Victoria Falls is not at all an immediate possibility. In fact, a new steam station is about completed, at Brakfran, while a second similar station at Germiston is under construction. The first has a capacity of 8,000 horsepower and the latter 16,000 horsepower.

G.

EASTERN CANADA.

OTTAWA, OCTOBER 24.—The new electric line, the Montreal & Southern Counties Railway, which some time ago secured an entrance into Montreal from the South Shore, has started construction work.

The proposal to lease the properties of the Mexican Light & Power Company to the Mexico Tramways Company meets with such adverse criticism from shareholders of the former company that the project has practically been shelved. Sir George Drummond's recent resignation from the presidency of this company is understood to have been by way of a protest against the sacrifice of its interests to the aggrandizement of the Tramways concern.

The Ontario Hydro-Electric Power Commission has announced that the engineers have adjusted the details of the construction of the Niagara Falls transmission lines with the contractors and work will commence at once.

In spite of the depression in business during the past year, the financial statement of the Montreal Street Railway shows that the road received an increase in gross and net earnings for the year ended September 30. The gross earnings are given at $3,677,432, and the operating expenses amounted to $2,158,394. The net income is placed at $1,136,411, and after dividend payments a surplus of $235,686 is left.

Much Canadian capital is invested in the West India Electric Company, which owns and operates the tram service at Kingston, Jamaica, James Hutchinson, of Montreal, being the president. This company operates about twenty-five miles of road, all of which is of first-class construction. The natives are employed as motormen and conductors and have been found fully competent for their respective duties.

W.

WESTERN CANADA.

WINNIPEG, OCTOBER 31.—Timely rains in Victoria, B. C., have put an end to the power famine in that city, and it is expected that there will be no more trouble before next summer, when it is intended that the British Columbia Electric Railroad Company will have a new power plant in operation. This company will erect a huge concrete dam at Coquitlam Lake, near New Westminster, B. C., for the purpose of increasing its power. This dam will be seventy-five feet high, ranging in width from forty feet at the base to the width of a wagon road at the apex.

The municipal electric street railway system at Edmonton, Alberta, was put in operation on October 26.

The city of Port Arthur, Ontario, has made a contract for the supply of 400 electrical horsepower, at $25 per horsepower, from the Kaministiquia Power Company of Fort William, Ont. The company will build a sub-station in Port Arthur, with a capacity of 2,000 horsepower, and will distribute power to manufacturing concerns in Port Arthur and Fort William.

The telephone line between South Pender and Pender Island, B. C., has been completed by the Dominion government, and arrangements are now being completed for the extension of the line to Mayne Island, giving through communication with Victoria, B. C. R.

IMPORTANT DEVELOPMENTS.

NEW PLANS FOR MOJAVE RIVER POWER SCHEME—A new company has been organized for the purpose of taking over the Westwater interests in the Victor dam project, and the great scheme of impounding the waters of the Mojave River by filling up the natural dam site at Victorville may soon be accomplished. The company has filed articles of incorporation under the name of the Mojave Water and Power Company, with an authorized capital of $2,000,000.

HUGE WATERPOWER DEVELOPMENT TO MANUFACTURE PAPER—The Minnesota & Ontario Power Company has been incorporated, with a capitalization of $7,000,000. The corporation plans to develop idle waterpower, establish a paper manufacturing center and conduct lumbering operations over a territory of 150,000 square miles. The board of directors is as follows: Edward W. Backus, William E. Brooks, Warrens Curtis, John A. Davis, of New York; W. A. S. Peabody, Alexander Smith, of Chicago, and Warren Curtis, Jr., formerly of Corinth, N. Y.

RECEIVERS FOR HUDSON RIVER COMPANIES—Receivers have been appointed for the Hudson River Electric Power Company, which was organized in 1903, and controls the Hudson River Water Power Company, Hudson River Electric Company, and Hudson River Power Transmission Company, together with various sub-companies owned by the last two named, supplying central and eastern New York state with power. The authorized capital stock was $10,000,000, of which $5,390,000 was issued. The total funded debt of the corporation, according to its last statement, was $9,683,500. Net earnings for 1907 were $486,200.

POWER DEVELOPMENTS AT NECAXA, MEX.—Contracts have been let by the Mexican Light and Power Company for the construction of the three tunnels and a canal to divert water to the reservoirs of the company at Necaxa. The tunnels will be, respectively, one of 1,400 meters and two of 350 meters in length, and the canal will be two or three kilometers in length. Two additional dams are to be built at Necaxa for the storage of this additional water supply. One of these dams will contain 800,000 cubic meters of material and the other 250,000 cubic meters. The power house at Nacaxa is also to be increased by two large concentrators, of 16,000 horsepower capacity. The Laguna reservoir dam has been completed and the reservoir is now about half full of water. This reservoir has a capacity of 44,000,000 cubic meters. The Los Reyes reservoir dam has also been completed and is practically full of water. This reservoir has a capacity of 12,000,000 cubic meters. Shareholders of the Mexican Light and Power Company will hold a special meeting in Montreal, Canada, on December 3, for the purpose of ratifying an increase of $3,800,000 in the preferred stock issue of that company.

PROMOTES $24,000,000 TROLLEYLESS STREET-RAILWAY SYSTEM FOR SAN FRANCISCO—John J. Egan, a promoter, concerning whom little appears to be known, is seeking a 25-year franchise in San Francisco for a street car system, to traverse 244 miles of streets, and to be established at an expenditure of $24,000,000. He says he has recently received a patent for a new type of electric street car system, the conductor rail being carried on the roof of the cars, projecting 25 feet ahead and the same distance behind. The ends are to touch poles set at regular intervals, thus keeping the car at all times connected with the source of current.

UNION TRACTION COMPANY, OF PHILADELPHIA, VOTES IN FAVOR OF $5,000,000 LOAN—Stockholders of the Union Traction Company, of Philadelphia, Pa., voted in favor of the $5,000,000 loan to the Philadelphia Rapid Transit Company, the holding company, 506,757 shares voting in favor and 3,435 against. After the announcement that the loan proposition was carried the following resigned: John B. Parsons, as president and director; George D. Widener, as vice-president and director; P. A. B. Widener, W. H. Shelmerdine, George H. Earle and J. J. Sullivan, as directors. E. A. Ballard then nominated the following, who were elected to the vacancies: John H. Chestnut, William P. Katz, Jacob S. Disston, Henry Fernberger, Edward M. Story and J. J. Sullivan. After the Union Traction meeting the stockholders of the Philadelphia Rapid Transit Company held a special meeting ratifying the Union Traction Company $5,000,000 loan.

INDEPENDENT INTERESTS PLAN NATIONAL LONG-DISTANCE SYSTEM—The reported combination of independent long-distance telephone interests to form a national long-distance system was confirmed at Buffalo, N. Y., on October 29, by B. G. Hubbell. "Contracts are now being closed," said Mr. Hubbell, "with twelve of the principal independent long-distance companies for the use of rights-of-way, poles and connections, and there is every prospect of early incorporation and the beginning of construction. The plan is to fill in the gaps between existing long-distance systems to form a single group, with Poughkeepsie, N. Y., as the eastern terminus, Kansas City as the western, and Mobile, Ala., as the southernmost point. Within this area will be united Chicago, Detroit and Michigan points, with Cleveland, Buffalo and Rochester to the east and St. Louis, Indianapolis, Louisville, Pittsburg, Scranton and Philadelphia, besides intermediate points."

PROPOSALS.

VACUUM CLEANING SYSTEM FOR FEDERAL BUILDING, CLEVELAND—The office of the supervising architect will receive sealed proposals until November 21 for the installation of a vacuum-cleaning system for the Federal building at Cleveland, Ohio, in accordance with specifications, which may be had at the above office or the office of the architect, Arnold W. Brunner, 33 Union square, West, New York city.

POSTOFFICE, GAINESVILLE, GA.—The office of the supervising architect, Treasury Department, Washington, D. C., will receive sealed proposals until December 8 for the construction (complete) of the U. S. postoffice at Gainesville, Ga., in accordance with the drawings and specifications, copies of which may be had at the above office or at the office of the postmaster at Gainesville.

ENGINEERING SOCIETIES.

BOSTON BRANCH, A. I. E. E.—The first monthly meeting of the Boston section of the American Institute of Electrical Engineers was addressed by Professor Charles M. Allen, of the Worcester Polytechnic Institute, on the subject, "Testing by Dynamometers."

WORCESTER POLYTECHNIC BRANCH, A. I. E. E.—The meeting of the Worchester Polytechnic Branch of the Institute, at Worcester, was given over to a discussion of the proceedings of the American Street and Interurban Railway convention at Atlantic City last month.

ELECTRIC LIGHTING.

TOPEKA, KAN.—The Great Bend Water & Electrical Company, with a capital stock of $80,000, has been granted a charter.

NASHVILLE, TENN.—The Tennessee Electric Company has been incorporated for $5,000 by I. L. Canoway, J. H. Rudisell and T. S. Sinson.

ANTLERS, OKLA.—An engineer has been employed to make estimates of cost of an electric-light plant which the city contemplates installing.

STOCKBRIDGE, MASS.—The Stockbridge Lighting Company seeks authority to issue $15,000 additional capital stock, making the total $40,000.

ALBANY, KY.—Five citizens have formed a stock company and Albany is to have an electric light plant. The plant will be installed at once.

BASTROP, TEX.—T. A. Orgain, city secretary, has charge of a project for the city to issue bonds for the purchase of an electric-light plant.

SPOONER, MINN.—Building on the Shevlin-Mathieu power house has been commenced. The structure throughout will be of concrete and steel.

BUFFALO, N. Y.—The Republic Electric Company has been incorporated for $5,000 by a number of incorporators, headed by William E. Robertson of Buffalo.

WARREN, OHIO—Mayor Kilpatrick has vetoed the ordinance passed in council in favor of the Hydro Electric Company and the Warren Water & Light Company.

STOYESTOWN, PA.—The Stoyestown Light, Heat & Power Company is to be organized, with a capital stock of $7,500. D. E. Long heads the list of incorporators.

COLUMBUS, OHIO—The East End Electric Company of Cleveland has been incorporated with a capital stock of $10,000. C. R. Foster heads the stockholders.

ROOSEVELT, N. Y.—The Roosevelt Waterpower and Light Company has been incorporated, with a capital stock of $40,000. Edward Uhe heads the incorporators.

MONTGOMERY, ALA.—The Choctawhatchie River Light and Power Company has been incorporated for $1,000,000, of which $500,000 is paid in. W. C. Fritter heads the incorporators.

SCHENECTADY, N. Y.—According to newspaper reports the Schenectady Illuminating Company is to erect an eight-story building at State and Barrett streets, on the site of the Park House.

JACKSONVILLE, FLA.—An ordinance before the city council provides for granting a franchise for an electric light and street railway system to M. M. Smith, W. D. Holden and A. Johnson.

HARRISBURG, PA.—Plans for a permanent decorative illumination of Market street and Market square have been made by the Harrisburg Light, Heat and Power Company. Several blocks are now thus illuminated.

FAIRFIELD, CONN.—A report on the cost of installing an electric lighting plant to light the villages of Fairfield and Southport, made at a meeting of the Fairfield Village Improvement Society, is now before the people of the town.

ELWOOD, IND.—The plant of the Citizens' Heat and Light Company, of Elwood, was sold at receiver's sale at the Anderson courthouse for $50,000, the purchase being made by E. R. Ester, a member of a committee representing the stockholders. The plant was appraised at $375,000. The Central Indiana Electric Company is expected to take over the Elwood plant as soon as it secures a franchise in Elwood. The bonded indebtedness of the Elwood company is $364,000.

FRANKFORT, IND.—The municipal electric light plant was wrecked October 27, sustaining $25,000 damage, by the explosion of a fourteen-ton flywheel. The governor on the 500-horsepower engine stuck, it is said, and pieces of the flywheel were hurled 300 feet.

ATLANTIC CITY, N. J.—Chairman Donnelly, of the council's lighting committee, has been authorized to secure bids for the lighting and illumination of the "boardwalk" next year. The present contract expires in a few weeks. Bids are to be received until November 9.

CARL JUNCTION, KAN.—Business men are urging a lighting system from the lines of the Joplin-Pittsburg Electric Railway, which passes through Carl Junction. It is understood that the company can furnish all power necessary and would wire the city at a reasonable rate.

BUENA VISTA, VA.—The Rockbridge Power Company has secured a franchise to furnish the city with electric light and power. The company proposes to develop waterpower on North River and furnish electricity to Buena Vista, Glasgow, Buchanan and possibly Lexington, Va., locating sub-stations in each city.

PLATTEVILLE, WIS.—O. M. Fox and M. F. Fox are considering extending electric light and power lines to Platteville, having already decided to build from Galena to Benton and Cuba City. The company which they head is erecting an electric power plant at Galena, to furnish light and power to the vicinity.

NAPA, CAL.—The board of supervisors has granted E. D. Lehe of Dixon a franchise to construct electric power lines over the roads of Napa County north from the city to the Lake County line, passing through St. Helena and Calistoga. Mr. Lehe plans to re-establish the electric lighting system at Calistoga.

BEDFORD CITY, VA.—A 1,000-horsepower hydro-electric plant is planned for a power site on the James River, 25 miles from Bedford City. There is a fall of seventeen feet at this point, and it is estimated that the present dam will generate 1,200 horsepower. The power would be transmitted and used to light the city.

LINDSAY, OKLA.—The board of trustees has called for an election on the proposal to appropriate $40,000 for a water and electric light system for Lindsay. The town is situated in a prosperous and growing country and apparently there is little opposition to the movement, and it is predicted that the election will carry by a large majority.

CHICAGO, ILL.—The Commonwealth Edison Company has obtained control of the property at the southeast corner of Quarry street and the Chicago River through a lease from Northwestern University. The tract contains 118,356 square feet, or almost three acres. The present lease is for ninety-five years from November 1 of the present year, the total rental being $308,750.

ST. LOUIS, MO.—Property owners of the district bounded by Fourth, Twelfth, Washington and Market streets, are discussing a uniform system of lighting for the downtown streets. A committee has presented figures on the cost of carrying out the plan in the district named, and interesting data from other cities, which have adopted the electrolier system, were furnished the property owners.

TERRE HAUTE, IND.—The directors of the Pleasant Shades Power Company, which was incorporated under the laws of Indiana September 1, for $100,000, have decided to locate the home offices in Terre Haute. M. H. Ewers, president of the company, heads the list of Terre Haute men who comprise the incorporators. The new company was organized to build a waterpower generating station and summer resort on Rocky River, or Sugar Creek, near Waveland, thirty-two miles from Terre Haute. The company owns about 400 acres of land. A dam 350 feet long and twenty feet high will be built to supply waterpower for generating 500 kilowatts of electric power, to be used in lighting the resort and operating an electric railway.

PROVIDENCE, R. I.—The stockholders of the Narragansett Electric Company will shortly be called upon to consider the advisability of an issue of $500,000 in 4 per cent debentures. The purpose of the issue is to retire a portion of the floating indebtedness of the company. This issue, if approved by the stockholders, will make the total of outstanding securities of the company of all classes $4,500,000.

BLUE ISLAND, ILL.—The Sanitary District of Chicago has entered into a contract to supply the town of Blue Island with light and power. Compensation was fixed on a basis of estimated returns to the District of $14,000 the first year and increases each year thereafter. The District is to take over the commercial lighting system and supply current to the residents of the town at a rate of 10 cents per kilowatt hour.

PUGET SOUND, WASH.—Work is progressing on the construction of the new $450,000 central power plant, which is being built at the Navy Yard. The Westinghouse Electric and Manufacturing Company has secured the contract for supplying a 1,000-kilowatt generator and a 500-kilowatt generator. These, in addition to the 500-kilowatt generator previously contracted for, will give the plant a generating capacity of 2,000 kilowatts.

CHATTANOOGA, TENN.—The Chattanooga-Tennessee River Power Company awarded a contract to Guild & Company of Chattanooga, to furnish material and construct a transmission line fifteen miles long from Hale's Bar to Chattanooga. Steel towers resting on concrete foundations will be erected along the right-of-way. The contract involves the expenditure of about $150,000. The company is constructing a hydro-electric plant at Hales Bar to secure an ultimate development of 56,000 horsepower.

OBITUARIES.

MR. HENRY A. BUTTERS, president of the Northern Electric Railway Company, died in Berkeley, Cal., last week. He was widely known as a mining man and capitalist.

DR. DANIEL C. GILMAN, first president of the Johns Hopkins University, Baltimore, Md., and afterward head of the Carnegie Institute, Washington, died on October 14 at Norwich, Ct., at seventy-seven years of age. Educated first at Yale and then at Cambridge and Berlin, he became president of the University of California in 1872. Five years later he went in the same capacity to the Johns Hopkins University. His work there, which lasted until 1901, secured him a place among the foremost American educators. In 1891 Dr. Gilman left Baltimore for Washington, where he spent three years organizing the Carnegie Institute. In addition to the work of his various university appointments, Dr. Gilman was appointed by President Cleveland to act as commissioner in the Venezuela and British Guiana boundary dispute. He was president of the American Oriental Society, and a prominent member of various learned societies and institutions.

NEW PUBLICATIONS.

NATIONAL BOARD OF FIRE UNDERWRITERS—Among recent publications of the National Board of Fire Underwriters are two leaflets giving rules and requirements for the construction, installation and use of coal gas producers on both the pressure and suction system, and rules for the construction and installation of incubators and brooders. Devices heated by coal, gas or electricity are regarded as much less hazardous than those heated by oil flames.

THE ARMOUR ENGINEER—During the coming year there will be published Volume I of the Armour Engineer, the new semi-annual technical publication of the student body of the Armour Institute of Technology, Chicago. This is an engineering magazine issuing two large numbers each year, one for each semester. The Armour Engineer is to contain technical articles by prominent Armour graduates, results of research in the Armour testing laboratories, the best papers presented before the engineering societies, editorials, book reviews, engineering notes and comments.

TELEPHONE AND TELEGRAPH.

WILKES-BARRE, PA.—The Bell Telephone Company has been given permission to start the work of laying its wires in the central part of the city under ground.

SPOTTSYLVANIA, PA.—The Caroline Telephone Company is extending its line to the town of Bagby, in that county, and will run it from there to Port Royal, on the Rappahannock River.

NASHVILLE, TENN.—The Limestone Telephone Company has been incorporated to operate in Washington County, with a capital stock of $3,000. S. B. Moreloch heads the incorporators.

READING, PA.—The Mt. Zion Rural Telephone Company has been organized by farmers and business men of Mt. Zion. The line will cover a territory of twenty miles, including Mt. Ætna, Frystown and Lebanon.

BIRD ISLAND, MINN.—The village council has granted a franchise to A. C. Bowe, of Merriam Park, for the installation of a telephone system. Mr. Bowe will put in a modern plant, using the common battery system.

GROTON, VT.—The Groton Telephone Company has been organized, with a capital stock of $10,000, for the purpose of maintaining telephone lines in the towns of Groton, Bradford, Topsham, Barnet, Corinth, Newbury, Peacham and Ryegate.

BOYDS, MD.—The Boyd Telephone Company, supplying Montgomery, Frederick and Carroll counties, later controlled by the American Union Company, has been sold, with all franchises, to the recently organized Montgomery Telephone Company, which plans to build an independent line, with metallic circuit.

CORDOVA, ALASKA—Mummy Island, about eight miles from Cordova, has been selected as the site for the navy wireless station, to be established on the Alaskan coast to close communication between the coastal wireless station of the navy and the military Alaskan telegraph system. Work on the new station already has begun.

NEW BRUNSWICK, N. J.—The Middlesex Telephone Company, of Monmouth Junction, is capitalized at $10,000, of which $1,000 is subscribed. The incorporators are: Clarence S. Groves, of Dayton; D. C. Mershon, Prospect Plains; Andrew Ely, Dayton; A. V. Stout, Monmouth Junction; W. J. Rowland, Monmouth Junction; George W. Waite, Deans.

BOYDS, MD.—A meeting attended by residents of Poolesville, Dickersons, Boyds, Dawsonville, Barnesville and other points was held at Poolesville recently for the purpose of organizing a telephone company. A metallic system will be installed. Howard G. Spurrier, of Poolesville, was elected president of the company. A. D. Trundle vice-president and Reginald J. Darby secretary-treasurer.

PHILADELPHIA, PA.—The Keystone Telephone Company has taken no action upon the proposed plan to form the Keystone and other independent telephone companies into a concern to handle long-distance telephone and telegraph business all over the country. It is stated, however, that the new company will be incorporated with a capitalization of between $10,000,000 and $20,000,000.

DELHI, LA.—The West Carroll Telephone and Improvement Company has been formed, with a capital of $10,000, to build and maintain a telephone system covering the territory embracing Richland parish and other parts of the state. It will be a subsidiary of the Cumberland Telephone and Telegraph Company. The president is W. B. Redmond. Local exchanges will be maintained at Delhi, Floyd, Kilborn, Calvert and Pioneer.

HARRISBURG, PA.—The Bear Gap & Numidia Telephone Company, the line of which touches towns in Northumberland, Columbia, Mountour and Schuylkill counties, has been incorporated with a capital stock of $5,000. Adam W. Dimmick, of Paxinos, is treasurer. Lavelle Telephone and Telegraph Company, touching towns in Schuylkill, Columbia and Northumberland counties, has been incorporated for $5,000; H. O. Lenker, Lavelle, is treasurer.

PERSONAL MENTION.

MR. PAUL W. HORBACH will succeed Mr. E. J. Sullivan as manager of the Nebraska Electrical Company at Omaha, Neb., of which he is president.

M. HENRI POINCARE has succeeded the late Henri Becquerel as president of the French technical commission on radiotelegraphy appointed March 5, 1907.

MR. BION J. ARNOLD of Chicago has been elected an honorary member of the engineering fraternity, Tau Beta Pi. He was initiated into this honorary society on October 30.

MR. C. O. BAKER, of New York city, the head of the well-known platinum house of Baker & Company, who had been dangerously ill for six weeks past, is again in good health and active service.

MR. MARK LOUD of Dallas, Tex., who is associated with Stone & Webster, was a New York visitor last week. While in the city he was tendered a luncheon at the Machinery Club by Capt. Willard L. Candee.

MR. L. H. VAN ALLEN, at one time general superintendent of the New York Central, has been appointed general manager of the Buffalo, Genesee & Rochester Traction Company, with headquarters in Buffalo, N. Y.

MR. E. W. GOLDSCHMIDT, New York manager of the Wagner Electric Manufacturing Company, was to sail November 6 on the White Star liner Cretic for Naples, expecting to remain abroad until the first of the year.

MR. JAMES RAYMOND DEANE was married on October 15 to Miss Cornelia Mercedes Donovan at St. Vincent's Church, Chicago, the Rev. P. V. Byrne officiating. Mr. Deane is associated with the Guarantee Electric Company.

MR. GEORGE R. DENEHIE, formerly of the Tampa Electric Company, Tampa, Fla., will succeed George F. Morse as master mechanic of the Terre Haute, Indianapolis & Eastern Traction Company at Terre Haute, Ind. Mr. Morse becomes master mechanic of the Tampa Electric Company.

DR. A. RAPP and MESSRS. G. GRABBE, C. F. BAUMANN and S. HEISEY of Berlin, Germany, are visiting automatic telephone plants throughout the country on a trip of inspection, escorted by Dr. Frank of New York and Dr. Sulsberger and Messrs. W. E. Cook and Russell of Chicago. The party has visited the automatic plants at Columbus, O., and Grand Rapids, Mich.

DR. JOHN W. HAYFORD, member of the international boundary commission of the United States and Mexico, and well-known as an engineer, has been appointed dean of the new school of engineering of Northwestern University, Evanston, Ill., and will take up his duties September 1, 1909. The new dean is a graduate of Cornell University, class of 1889, and is 40 years of age.

MR. ARTHUR WILLIAMS, recently made president and general manager of the Union Electric Light & Power Company of St. Louis, has resigned this position, which he had occupied but two months, succeeding Mr. V. N. Powelson. Mr. Williams went to St. Louis from the New York Edison Company, where he had built up a unique position as general inspector. It is rumored that Mr. Richard McCulloch of St. Louis will succeed Mr. Williams as the local executive head of the Union Electric Light and Power Company.

MR. VAN RENSSELAER LANSINGH, illuminating engineer, of New York, delivered an address before the electrical section of the Canadian Civil Engineers' Society at Montreal, October 22, emphasizing the necessity of engineers and architects working together to secure proper natural and artificial lighting of buildings. On November 5 a similar address was delivered before the Dayton (Ohio) Electrical Club, including representatives and engineers of the Dayton Lighting Company, local electrical contractors and jobbers, and a number of the owners and managers of large buildings.

MR. G. HENNING YOUNGREN, for some time past western advertising manager of the Manhattan Electrical Supply Company, will engage in the preparation of technical copy for advertisers and institute follow-up systems and publicity campaigns, particularly among the members of the electrical industry. Mr. Youngren's headquarters are at 630 North Humphrey avenue, Oak Park, Ill.

MR. HERBERT H. EVANS, of Chicago, a collaborator on the report of electrification of railway terminals and the Illinois Central, made under the auspices of the committee on local transportation, city council, has received an appointment as secretary of the committee, a position created by the council in view of the volume of important business to be considered during the next two years. Mr. Evans is a mechanical engineer and a brother of Dr. W. A. Evans, city health commissioner, a joint author of the electrification report with Alderman Foreman and Messrs. Paul P. Bird and Gilbert E. Ryder, of the city smoke inspection department.

ELECTRICAL SECURITIES.

Last week was marking time in the stock markets generally, biding the result of the election. The very obvious improvement steadily going on in business conditions all over the country has discounted to a considerable degree the apprehension which has been felt as to the turn affairs might take in national politics. Some convincing signs of betterment are seen in the reports of increased earnings of railroads, particularly those roads operating in western territory. The statement of the United States Steel Corporation of its September quarter's earnings is also very favorable. The gross traffic returns for the month of September of the Rock Island system, the Omaha, and the Minneapolis & St. Louis, were all above those of September, 1907. The Union Pacific gained $464,000, and the Northern Pacific $209,000. Eastern roads, while failing to show the same improvement, are recovering slowly.

ELECTRICAL SECURITIES FOR THE WEEK ENDED OCTOBER 31.

New York:	*Closing.*
Allis-Chalmers common	11⅝
Allis-Chalmers preferred	39½
Brooklyn Rapid Transit	48¼
Consolidated Gas	144½
General Electric	142¾
Interborough-Metropolitan common	9¾
Interborough-Metropolitan preferred	28¾
Kings County Electric	125
Mackay Companies (Postal Telegraph and Cables (common)	73
Mackay Companies (Postal Telegraph and Cables (preferred)	69⅞
Manhattan Elevated	135
Metropolitan Street Railway	24
New York & New Jersey Telephone	114
Western Union	59¼
Westinghouse Mfg. Company	82
Boston:	*Closing.*
American Telephone and Telegraph	126⅝
Edison Electric Illuminating	232
Massachusetts Electric	54
New England Telephone	120
Western Telephone and Telegraph preferred	70
Philadelphia:	*Closing.*
Electric Company of America	9¾
Electric Storage Battery common	35
Electric Storage Battery preferred	35
Philadelphia Electric	11⅜
Philadelphia Rapid Transit	22¾
United Gas Improvement	86¼
Chicago:	*Closing.*
Chicago Telephone	123½
Commonwealth Edison	108
Metropolitan Elevated preferred	42
National Carbon common	68
National Carbon preferred	111

NEW MANUFACTURING COMPANIES.

THE AMERICAN ELECTRICAL MANUFACTURING COMPANY, Orange, N. J., has been incorporated, with a capital stock of $350,000. John C. Ireland, Everett Frohman and T. Wesley Wright are the incorporators. The company will manufacture electrical and mechanical goods.

ELECTRIC RAILWAYS.

SUSQUEHANNA, PA.—A new interurban line is projected between Factoryville and Susquehanna.

PITTSBURG, PA.—Pay-as-you-enter cars have been put into service on the principal lines of the Pittsburg Railways Company.

DETROIT, MICH.—The Detroit United Railways Company has put into service a handsome new funeral car which cost $8,000.

WHEELING, W. VA.—The Union Traction Company's line now operating between Sistersville and New Martinsville will be extended to Hannibal.

GLEN ROSE, TEX.—J. Mercer Carter, who is engaged in promoting an interurban road into Glen Rose, announces that $50,000 worth of stock has been subscribed.

WILMINGTON, DEL.—The Wilmington & West Chester Electric railway has secured its right-of-way through Delaware and the greater part of the Pennsylvania section.

EUGENE, ORE.—The Mackenzie River Power & Railway Company, which is incorporated with a capital stock of $100,000, plans an electric road from Eugene to Belknap.

NORTH FORK, W. VA.—Capital has been secured for building an electric road from North Fork to Elkhorn, a distance of four miles. Work is to commence as soon as a franchise is secured.

JOLIET, ILL.—The Joliet & Southern Traction Company has begun running its cars on the New Lenox line. When the line from Joliet to Chicago Heights is completed, a half-hour schedule will be inaugurated.

WINONA LAKE, IND.—$300,000 will be expended by the Winona Interurban Railway Company to rush completion of the Warsaw-Peru division, giving through service from Benton Harbor, Mich., to Louisville, Ky.

LOWELL, MASS.—The Lowell, Acton & Maynard Street Railway Company has applied to the State Railroad Commission for permission to increase its capital stock by $25,000 at par, the amount to be used for extensions.

PUEBLO, COLO.—The Kansas-Colorado Railroad is in possession of the entire right-of-way from Turkey creek to the city limits and will ask the council for privileges on the city streets, promising that cars will be running within a year.

LA CROSSE, WIS.—Officers of the Sparta-Melrose Electric Railroad Company expect to begin operations in 1909 on the construction of a line between those two cities via Cataract, Angelo and Trout Falls, the road to be twenty-eight miles long.

NEW YORK, N. Y.—The New York & Queens Railroad Company has been granted by the Board of Estimate and Apportionment the franchise which has been pending for some time to construct extensions of its lines to Whitestone and Bayside.

JACKSON, MICH.—Work on the Jackson-Lansing electric line of the Michigan United Railways is to be rushed to completion, the contract for construction having been let to A. L. Drum & Company of Chicago. Cars are promised to be running by March of next year.

ALLENTOWN, PA.—The service of the Electric Express Company over the lines of the Lehigh Valley Transit Company has proved successful beyond all expectations. Goods are carried directly to the doors of farmers along the route, and the service is to be extended.

MODESTO, CAL.—The surveying corps of the Stockton-Modesto trolley line reached Modesto, having completed the survey between the two cities. Applications for franchises in both Modesto and Stockton will be made this week, and construction work will begin within a month. Private right-of-way has been obtained for the entire distance between the two cities, and the promoters expect to have the road finished by next July. It will later be extended to Turlock and other points down the valley, giving the producer direct communication with tidewater at Stockton.

EL PASO, TEX.—The organization of the El Paso & Fort Hancock Railroad Company has been projected. Charles N. Bassett is president of the company. The capital stock defined in the charter to be applied for is $100,000. The road will be built from El Paso to Fabens and later to Ft. Hancock.

PIERRE, S. D.—Articles of incorporation have been filed for the Dakota Southern Railway Company, with headquarters at Lemmon, S. D. It is organized by local men and proposes to construct a line from Rapid City to Williston, N. D., by way of Lemmon, and, as set forth, is capitalized at $90,000,000.

SEATTLE, WASH.—The Seattle & Issaquah Electric Railway Company has been chartered, with a capital stock of $2,000,000, by Edwin S. Gill and John McQuade, with the purpose to acquire, construct, equip, lease, own and operate steam or electric roads between points in King and Snohomish counties.

EVANSVILLE, IND.—Directors of the Evansville & Southern Indiana Railway Company, which includes interurban lines from Princeton to Evansville and the Evansville street railway system, have voted to extend the line, which will eventually connect Evansville and Terre Haute, northward from Patoka in the early spring.

AUGUSTA, GA.—An electric trolley line is projected from Augusta to Edgefield, one of South Carolina's most historic county seats. A contract for the survey work has been awarded, and prospects seem good for completion of the road within a short time.

GARY, IND.—A new interurban road, to be known as the Valparaiso, Hobart & Gary railway, is said to have the support of ample capital and to be built as soon as certain franchises are obtained. Among those interested is James Hopkins, son of Senator Hopkins of Illinois.

UVALDE, TEX.—The driving of the first spike in the Uvalde city railway lines was performed with much ceremony on October 20. Mayor Mat Burney of Uvalde and Mayor W. L. Rawlinson of Sansom wielded the hammers. M. M. McFarlane, who is the promoter of the enterprise, says the line will be in operation by December 1.

LEAVENWORTH, KAN.—In preparing to operate trains by electricity through the Cascade tunnel, the Great Northern Railroad is building a low concrete dam in the Wenatchee River, together with 11,000 lineal feet of nine-foot wooden flume and 1,000 feet of steel flume, to convey water to its power house. It is expected that the plant will be in operation by January 1.

ALTOONA, PA.—An electric trolley line from Altoona to Bedford Springs, by way of Morrison's Cove, has been definitely planned. The road will be fifty miles in length and will pass through Duncansville, Hollidaysburg, Roaring Spring, Martinsburg, New Enterprise and Woodbury. The estimated cost of the construction of the road, power plants and rolling stock is $1,500,000.

WEST NEWTON, PA.—Work will start next week on rival street railway lines between West Newton and Herminie, ultimately to be extended to form a short-cut line between the Youghiogheny and Monongahela valleys. The Jeannette, West Newton and Monongahela Valley Street Railway Company is placing grade stakes on its route, and the Pittsburgh & Westmoreland Company has a line partly constructed through the town and work will be resumed next week.

BUFFALO, N. Y.—A report favorable to the Buffalo & Lackawanna Traction Company has been filed by Michael Danahy, Michael F. Schelling and William B. Cutler, the commission appointed by the Appellate Division. The Buffalo & Lackawanna is in reality the Buffalo & Lake Erie Traction Company. The commission found that the route is the shortest possible between West Seneca and the business heart of Buffalo and that the distance can be traveled in thirty minutes less time than by the present route of the International Railway.

WASHINGTON, D. C.—Plans are being matured for the construction of a second trolley line between Washington and Baltimore. The plan is to close the gap between Ellicott City, Md., and Sligo, by the construction of new tracks, making use of the trackage of the Washington Railway & Electric Company, on the Brightwood line, and the Seventh street line of the Capital Traction Company for entrance to the district, and the tracks of the United Railways of Baltimore over the Ellicott City branch for entrance to Baltimore.

DATES AHEAD.

Association of Car-Lighting Engineers. First annual meeting, Chicago, Ill., November 18.

National Society for the Promotion of Industrial Education. Annual meeting, Atlanta, Ga., November 19-21.

International Independent Telephone Association. Annual convention, Chicago, Ill., December 1-3.

American Society of Mechanical Engineers. Annual meeting, New York city, December 1-4.

American Roentgen Ray Society. Annual meeting, New York city, December 28-30.

Chicago Electrical Show. Coliseum, Chicago, Ill., January 16-30, 1909.

American Association for the Advancement of Science. Annual meeting, Baltimore, Md., January, 1909.

Northwestern Electrical Association. Annual meeting, Milwaukee, Wis., January, 1909.

INDUSTRIAL ITEMS.

THE WESTERN ELECTRIC COMPANY, Chicago, in booklet No. 1150, explains the advantages of lead-covered telephone cable for aerial and underground purposes. Several pages of general instructive matter on the subject of cables are followed by a detailed description of the cable products of the company.

THE UNDERWRITERS' LABORATORIES, INCORPORATED, 382 East Ohio street, Chicago, has issued a thirty-six-page booklet descriptive of the nature of its work and the terms and conditions under which it conducts tests of fire-resisting appliances and materials. The laboratories are under the control of the National Board of Fire Underwriters.

ROSSITER, MACGOVERN & COMPANY, dealers in electrical machinery, Whitehall Building, 17 Battery place, New York city, have purchased the Charles E. Dustin Company, dealer in electrical, steam and miscellaneous machinery, formerly at 11 Broadway, New York city, and the offices of the latter company have been moved to those of the former.

THE EXCELLO ARC LAMP COMPANY, New York and Chicago, has published a new catalogue describing the Excello flaming arc lamp and its advantages for various kinds of lighting and giving full data on the various types of this lamp made. In a pamphlet entitled "Seen Everywhere" the company gives nearly thirty views showing installations of Excello lamps.

THE BAY STATE INSULATED WIRE AND CABLE COMPANY, Hyde Park, Mass., announces that it has no further business connection with the Western Wire Sales Company of Chicago, Ill., as the latter company has ceased to be its agent. Hereafter Mr. Richard Wick, 356 Dearborn street, Chicago, will represent the Bay State Insulated Wire and Cable Company in the Chicago district.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has issued a new bulletin relating to Ward Leonard load boxes, a loading device for replacing lamp banks. Different capacities are made, from 10 amperes to 23½ amperes on 120-volt circuits, and from 5 to 12 amperes on 240-volt circuits. A combination or double-voltage rheostat giving 24 amperes on 110 volts and 12 amperes on 220 volts, is listed. The bulletin declares that many of these rheostats are in daily use by the leading electric light companies of America, among the more prominent users being the Edison companies of New York, Detroit, Chicago and Brooklyn, and the Public Service Corporation of New Jersey.

THE CENTRAL ELECTRIC COMPANY, Chicago, has completed arrangements to sell and carry a Chicago stock of Ward Leonard meter-testing rheostats. A catalogue will shortly be issued describing these rheostats, together with full illustrations indicating the methods of applying them to testing of commercial meters of both alternating-current and direct-current circuits. A copy of this catalogue will be sent upon request.

THE HOLOPHANE COMPANY, New York, has published bulletin No. 11, devoted to high-efficiency reflectors. These have been particularly designed for use with Gem, tantalum and tungsten lamps, and are built on the new equal prism principle. The reflectors are made in three different types, extensive, intensive and focusing. In the bulletin there is also included a mass of data valuable in designing illumination with the new reflectors.

DOSSERT & COMPANY, 242 West Forty-first street, New York, reports the receipt of the following orders during the current week: 350 cable taps for feeder cable, from the Chicago City Railway Company; 1,750 two-ways, three-ways and fuse box plugs from the Edison Electric Illuminating Company of Brooklyn, and 800 connectors of various sizes and styles from the Western Electric Company of New York, for export to South Africa and the Klondike.

THE L. E. KNOTT APPARATUS COMPANY AND THE ARTHUR W. HALL SCIENTIFIC COMPANY announce that they will combine their respective assets and business experience, with a view to rendering the best possible service. Arthur W. Hall is to be actively connected with the new management. E. Cate, after more than a year's absence, partly abroad, resumes his connection. L. E. Knott retires. The business address continues to be 16 Harcourt street, Boston, Mass.

THE FOOS GAS ENGINE COMPANY, Springfield, O., announces that the United Cigarette Machine Company, of Lynchburg, Va., which has used several Foos engines in its power plant for eight or ten years, has recently placed an order for one of the Foos Company's 100-horsepower, multiple-cylinder vertical engines and producer gas plants complete. The engine will be direct connected to a General Electric generator, which is to supply current for the operation of the new plant nearing completion.

THE RAIL JOINT COMPANY, Troy, N. Y., at the annual meeting of its stockholders, held on October 28, chose directors as follows: George G. Frelinghuysen, Frederick T. Fearey, E. Y. Weber, C. P. Wheeler, Mark T. Cox, Marcus L. Ward, F. C. Runyon, L. F. Braine, Percy Holbrook, Benjamin Y. Wolhaupter and George A. Weber. The directors of the company organized with these officers: Chairman of the board, George G. Frelinghuysen; president, Frederick T. Fearey; vice-presidents, L. F. Braine and Percy Holbrook; secretary, Benjamin Y. Wolhaupter; treasurer, F. C. Runyon.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, has issued a handsome catalogue, B-18, describing and listing Benjamin wireless clusters and lighting specialties. Conveniently indexed are complete lists of cluster bodies and ceiling, pendant, special and weatherproof fixtures and miscellaneous materials. Many special and ingenious forms of fittings are described. The extensive lists give code word, catalogue number, description, list price and weight of package for each article mentioned. In its typographical and mechanical make-up the catalogue is unique and very convenient.

THE MASCHINENFABRIK OERLIKON, near Zurich, Switzerland, has distributed recently a number of publications of special interest. A well-illustrated bulletin of thirty-six pages describes the power plant and transmission system of the Societa Mineraria ed Elettrica del Valdarno in Italy. A seventy-two-page bulletin gives a full description of the single-phase railway from Seebach to Wittingen, Germany. Other publications are devoted

to the 52,000-volt power transmission system from Gaucin to Seville, electric installations driven by wind power, high-speed motor generator sets and automatic limit devices for electrically driven cranes.

THE WHEELER CONDENSER AND ENGINEERING COMPANY, Carteret, N. J., has published a 24-page booklet entitled "Surface Condensers." The subject matter includes chapters on the economy of running condensing, the advantages of different types of condensers, and a description of Wheeler surface condensers. The Volz combined feed-water heater and condenser, in which some of the tubes serve as a primary heater, is described, and there is a section on turbine condenser outfits. The final part of the catalogue is devoted to notes and suggestions on the installation and operation of surface condensers. The illustrations show the various types of Wheeler Admiralty and Wheeler-Volz surface condensers and waterworks condensers, and a number of the large steam power plants of the country. This booklet is one of a series of engineering treatises which the Wheeler Condenser and Engineering Company is distributing, and will be of interest and value to any engineer who is called upon to design, construct or manage steam plants.

THE PETTINGELL-ANDREWS COMPANY, Boston, is marketing a number of devices designed to prevent the theft of current. In the forthcoming issue of the company's new publication, Juice, the "O. K." fuse block cover and "O. K." meter connection block are to be described. The former is a device for covering branch blocks so as to prevent illegal connections or the refusing of blocks on discontinued services. The meter connection block makes it possible to carry the service wires in conduit from entrance to meter, leaving no exposed wires in the customers' premises. This block is designed to facilitate the testing or replacement of meters, without interrupting the customers' service, or the necessity of opening tap joints or cutting wires. These two devices are being extensively used by some of the larger central stations, and the knowledge of their merits will undoubtedly be of interest to every central-station man.

RECORD OF ELECTRICAL PATENTS.

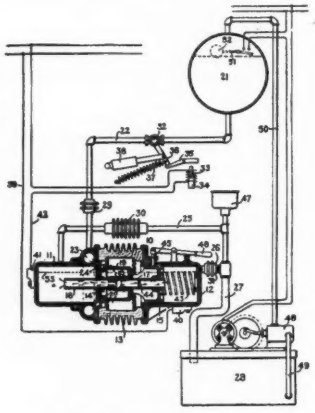
Issued (United States Patent Office) October 27, 1908.

901,939. CUT-OUT BOX. Thomas Q. Andrazyk, Chicago, Ill. Filed July 29, 1907. An asbestos-lined cut-out box.

901,942. WAVE-RESPONSIVE DEVICE. Clifford D. Babcock, New York, N. Y., assignor to United Wireless Telegraph Company, New York, N. Y. Filed August 27, 1906. The device has an adjustable contact engaging a spring contact arm.

901,944. CAR TRUCK. Asa F. Batchelder, Schenectady, N. Y., assignor to General Electric Company. Filed January 29, 1908. The motor armature is mounted on one axle and a combined bolster and motor field is supported on the side frame.

901,957. TELEGRAPHIC CODE CONDENSER. Matthew B. Dickie, Glasgow, Scotland, assignor to Nobel's Explosives Company, Limited, Glasgow, Scotland. Filed February 21, 1908. Three circular scales are arranged parallel and have different numbers and letters.



901,967.—OIL SWITCH

901,958. RAILWAY SIGNAL. Heinrich Diehl, Berlin, Germany, assignor to General Electric Company. Filed April 23, 1907. Means carried by the moving car throw light on selenium cells, which control the signal.

901,965. PREPARATION OF ELECTROTYPE MOLDS. Albert W. Harrison, Baltimore, Md. Filed July 16, 1906. The ingredients are in the proportion of one gallon of water, one ounce of kainite and a small quantity of graphite.

901,966. SOLUTION FOR TREATING ELECTROTYPE MOLDS. Albert W. Harrison, Baltimore, Md. Filed December 7, 1906. This solution consists of nitrate of soda dissolved in water, with graphite added thereto.

901,967. OIL SWITCH. Edward M. Hewlett, Schenectady, N. Y., assignor to General Electric Company. Filed November 7, 1904. A circulating oil system comprises a reservoir and a pump for storing oil under pressure therein.

901,974. TELEPHONE REPEATER. Lucius A. Lindsey, Crystal Springs, Ga. Filed March 20, 1906. The repeater has a carbon button, one plate of which is attached to the diaphragm.

901,975. RACK-RAIL LOCOMOTIVE. George E. Lynch, Columbus, Ohio, assignor to Jeffrey Manufacturing Company. Filed January 26, 1906. A motor-driven locomotive.

901,976. CURRENT-COLLECTING MEANS. Campbell Macmillan, Schenectady, N. Y., assignor to General Electric Company. Filed February 12, 1906. A rotating collecting ring and a stationary ring are connected by a rotating contact member.

901,977. MICROPHONE APPARATUS FOR TELEPHONE AND OTHER CIRCUITS. Quirino Majorana, Rome, Italy. Filed July 7, 1906. There is provided a liquid supply tube and an elastic connection between the diaphragm and the outlet end of the tube.

901,981. SUSPENSION DEVICE FOR TROLLEY WIRES OR OTHER CONDUCTORS CARRYING CURRENTS OF HIGH VOLTAGE. George A. Mead, Mansfield, Ohio. Filed December 2, 1904. A bracket has an insulator sleeved thereon. A trolley wire is supported by the insulator and an insulated brace rod is connected to the wire.

901,993. CARBON PENCIL OF ELECTRIC ARC LIGHTS. John Nicholson, Frackville, Pa. Filed April 20, 1908. This arc lamp electrode comprises a cored carbon pencil having a metal cap and metal jacket.

901,997. ELECTRIC RAILWAY SYSTEM. Horace F. Parshall, London Wall, London, England, assignor to General Electric Company. Filed August 19, 1904. A switch on the car for automatically changing the car circuits from single-phase trolley to direct-current third rail.

902,003. ELECTRIC FIREPLACE. Alfred D. Rathbone, Grand Rapids, Mich. Filed February 4, 1908. The heating element is made luminous.

902,004. PLURAL-LAMP FIXTURE. Frank J. Russell, New York, N. Y. Filed October 20, 1906. A wireless cluster bracket.

902,014. SIGNALING SYSTEM FOR RAILROAD TRAINS. Shellman T. Stewart, Newark, N. J. Filed January 31, 1908. This system is equipped with gates to make and break the signal circuit and latches for locking the gates and a second circuit to operate the latches.

902,017. ELECTRIC CAR TRUCK. Fernando F. Stowe, Worcester, Mass. Filed March 10, 1905. Renewed March 16, 1908. On the truck frame is an electric motor and spring-pressed cone bearings holding the motor in place in the frame.

902,019 and 902,020. DYNAMO-ELECTRIC MACHINE. Karl Sulzberger, Charlottenburg, Germany, assignor to General Electric Company. Filed April 8, 1905, and December 12, 1906. A rotating field magnet has a distributed winding and special winding holders arranged between the parts of the same.

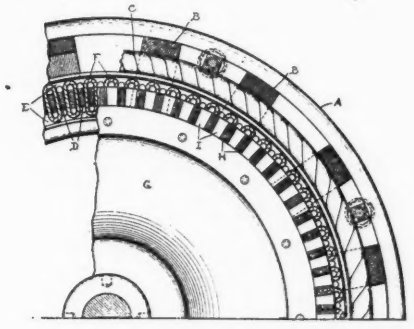
902,024. ELECTRIC HEATER. Elihu Thomson, Swampscott, Mass., assignor to General Electric Company. Filed June 17, 1907. In this heater is a fluid container, an electric heating device and a casing forming a condensing space for the fluid.

902,026. RAIL BOND. Eugene W. Vogel, Chicago, Ill., assignor to the Railroad Supply Company, Chicago, Ill. Filed February 9, 1906. The bond has shallow superficial grooves in its outer surface.

902,028. ELECTRIC SIGN. Henry J. Walser, Cleveland, Ohio. Filed May 29, 1906. This is an advertising display sign.

902,032. INCANDESCENT ELECTRIC LAMP. Willis R. Whitney, Schenectady, N. Y., assignor to General Electric Company. Filed October 31, 1904. The patent relates to the base terminals.

902,033. SWITCH MECHANISM. John B. Wiard, Lynn, Mass., assignor to General Electric Company. Filed April 28, 1906. A reversing switch has two sets of resilient contact fingers and a rocker member.



902,195.—TELEPHONE RELAY

902,035. ELECTRIC RAILROAD SWITCH. Merle J. Wightman, New York, N. Y. Filed January 2, 1908. A motor-operated track switch.

902,040. WIRE CONNECTOR. Homer W. Wyckoff, Indianapolis, Ind.; Nathan H. Richardson, administrator of said Homer W. Wyckoff, deceased. Filed March 12, 1906. Two metal plates are placed on each side of the wire and clamped together by a bolt.

902,043. TELEPHONE TRANSMITTER. George F. Atwood, East Orange, N. J., assignor to Western Electric Company, Chicago, Ill. Filed March 12, 1906. The containing case of the transmitter has a chamber secured to its rear wall.

902,048. MOLDED RESISTANCE. Lawrence E. Barringer, Schenectady, N. Y., assignor to General Electric Company. Filed February 2, 1906. Constituents are comminuted conducting material and hydrous silicate of calcium.

902,061. MOTOR CONTROLLER. Henry F. Elshoff, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed June 30, 1906. A multiple-voltage controller has a drum controlling the resistance switches.

902,065. DYNAMO-ELECTRIC MACHINE. Allan B. Field, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed May 13, 1907. A rotating field has damper rods extending through its field poles.

902,069. INCANDESCENT LAMP. Hugo Gernsback, New York, N. Y., assignor to the Motor Car Equipment Company, New York, N. Y. Filed March 12, 1907. A number of filaments are adapted to burn in parallel. Non-conductive stiffening members connect their feed wires.

902,074. SPEED INDICATOR. John L. Hall, Schenectady, N. Y., assignor to General Electric Company. Filed February 28, 1906. Electrically controlled means periodically lock a constantly rotating and an intermittently rotating member together.

902,099. SELECTIVE SIGNALING DEVICE. Ira F. Manny, Milwaukee, Wis., assignor to the Manny Signal Company, Milwaukee, Wis. Filed December 12, 1907. A motor-driven rotary member has escapement teeth engaged by the pawl and a signaling member that can be engaged by the pawl when it is moved out of the path of the teeth.

902,101. MOTOR CONTROLLER. Anthony L. McHugh, Cincinnati, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed June 30, 1906. A modification of No. 902,062.

902,105. ELECTRIC BELL. Charles H. North, Cleveland, Ohio, assignor to the North Electric Company, Cleveland, Ohio. Filed April 22, 1905. An adjustable weight is slidably mounted on the bell tapper for adapting the bell to selective actuation by different currents.

902,106. METHOD OF AND MEANS FOR UTILIZING THE PRESSURE IN THE INTERIOR OF AN ELECTRIC CONDUCTOR CARRYING CURRENT. Edwin F. Northrup, Philadelphia, Pa., assignor to the Leeds & Northrup Company, Philadelphia, Pa. Filed March 1, 1907. Chambers containing a liquid conductor communicate with each other by a passage from a point near the center of one chamber to a point more remote from the center of the adjacent chamber.

902,108. MOTOR CONTROLLER. William D. Pomeroy, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed December 31, 1906. A switch biased toward closed position is arranged to be opened by the drum when the latter is moved between certain positions.

902,118. SIGNAL SYSTEM. Burt A. Slater and Michael J. McDermott, Boise, Idaho. Filed March 5, 1908. An electric block signaling system for railways.

902,121. ELECTRIC FIXTURE. Edgar C. Suiter, Olympia, Wash. Filed April 30, 1907. A slack adjusting device for drop lamps.

902,157. PROCESS FOR PRODUCING PHOSPHORIC ACID. Frederick J. Maywald, Brooklyn, N. Y. Filed September 10, 1902. A low potential arc is applied to a granular mass of phosphates.

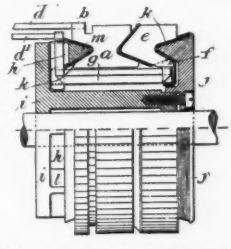
902,173. ELECTRIC CELL. Georges Schauli, London, England. Filed September 18, 1906. The metallic plate is a compound one, composed of a continuous fluid-tight plate and a perforated plate in metallic contact therewith.

902,176. RAILWAY SIGNALING SYSTEM. Carl J. Schwarze, Adrian, Mich. Filed July 18, 1906. Combined with a trolley wire are signaling conductors mounted on each side thereof.

902,184. ELECTRO-PNEUMATIC BRAKE. Walter V. Turner, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Filed March 20, 1905. An electric application valve for controlling the supply of air to the brake cylinder and a normally open electric release valve for controlling the exhaust port.

902,195. TELEPHONE RELAY. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed January 25, 1908. A high-frequency induction alternator has its stationary field winding connected in the primary circuit and the stationary armature connected in the secondary circuit.

902,216. ELECTRIC LAMP FOR HELMETS AND SIMILAR HEAD COVERINGS. Johann H. Dräger, Lübeck, Germany. Filed January 2, 1908. Mounted in the helmet is a battery connected with an electric lamp.



902,424.—DUPLEX COMMUTATOR

902,235. CABLE TIP. Louis Kellner, New York, N. Y., assignor to Metropolitan Switchboard Company. Filed November 11, 1907. The cable conductor fits into a conical hole, at the outer end of which is a screw plug.

902,244. ELECTRICALLY-CONTROLLED LOCK. Edward W. Marvel, Philadelphia, Pa., assignor to William H. Hollar, Philadelphia, Pa. Filed May 12, 1908. Electric motors operate the locking mechanism.

902,262. INSULATOR PROTECTOR. Robert R. Sparks, Greenfield, Mass. Filed May 20, 1908. About the insulator is a removable jacket forming a housing.

902,275. BANK OF LOCKING SWITCH KEYS. Elmer R. Corwin and Charles A. Bals, Chicago, Ill., assignors to Corwin Telephone Manufacturing Company, Chicago, Ill. Filed March 28, 1908. In a party line switch depression of any one of the push-buttons operates locking bars whereby any of the push-button keys which has been depressed is released.

902,285. CONDUIT. John A. Garey, Mound City, Mo. Filed August 12, 1907. A pair of loosely mounted plates is held by springs to form a wholly closing shield for the third rail.

902,297. RAILWAY SIGNALING APPARATUS. Winthrop K. Howe, Buffalo, N. Y., assignor to General Railway Signal Company, Buffalo, N. Y. Filed November 27, 1905. Renewed June 6, 1908. A double signal is operated by a motor through an electromagnet clutch for each signaling part.

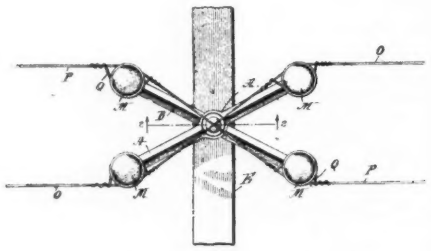
902,307. ELECTRIC CONTROLLING DEVICE. Harry W. Leonard, Bronxville, N. Y. Filed May 13, 1905. This motor starting box has an auxiliary movable contact device, carried by the main control switch, and means for causing this contact to quickly close the circuit independently of the rate of movement of the switch.

902,320. GAME REGISTER. Edward O. Parker and Harold E. Grey, Independence, Iowa. Filed April 19, 1906. Electrically operated means advance an index step by step and simultaneously operate an electromagnetic signal apparatus.

902,338. TELEPHONE SYSTEM. Paul V. Smith, Lyons, Kan. Filed December 22, 1906. An intercommunicating system.

902,354. ELECTRODE FOR ARC LAMPS. Willis R. Whitney, Boston, Mass., assignor to General Electric Company. Filed December 10, 1903. An electrode formed from a pure metal having a melting point higher than iron and yielding a luminous or flaming arc.

902,356. FOUR-PARTY-LINE INDICATING RINGING KEY. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed August 3, 1907. There are four switch-actuating plungers and four auxiliary plungers, one for each of the previous ones to indicate the last one that has been depressed.



902,455.—TRANSPOSITION BRACKET

902,373. SPARK-PLUG ATTACHMENT. Frederick D. Casey, North Water Gap, Pa. Filed July 25, 1907. A cover for the plug has an opening to permit the passage of a conductor.

902,389. APPARATUS FOR CONNECTING CONDUCTING AND OTHER WIRES. Anthony Fodor, Budapest, Austria-Hungary. Filed November 14, 1907. Holding and twisting devices are independently adjustable, and there are means for locking the holding device in position.

902,396. CONTROLLING SYSTEM FOR ELECTRIC MOTORS. Jay H. Hall, Cleveland, Ohio, assignor to Electric Controller and Supply Company, Cleveland, Ohio. Filed March 13, 1906. A master controller for a number of motors.

902,420. TROLLEY GUARD. William D. Lewis, Plymouth, Pa. Filed April 11, 1908. A guard frame is provided at one end with a segment-shaped enlargement.

902,424. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES. Frederick H. Loring, London, England. Filed December 31, 1907. Two independent commutators are arranged side by side, integral projections being formed on the end face of one commutator and entering recesses on the end face of the adjacent one.

902,427. ELECTRIC SPARKING DEVICE. Willie H. R. Mildeprath, Jacksonville, Fla. Filed January 20, 1906. A stationary electrode is associated with a movable electrode operated by an electromagnet.

902,455. TRANSPOSITION BRACKET FOR INSULATORS. James E. Skinner, Kingman, Kan. Filed June 17, 1908. A pair of superimposed hubs is provided with radially projecting arms, having bearings at the free ends.

902,476. ELECTRIC LOCOMOTIVE. William Dalton, Schenectady, N. Y., assignor to American Locomotive Company, New York, N. Y. Filed July 22, 1907. There are two swiveling trucks having each a pair of guide wheels at each end and two pairs of driving wheels between the guide wheels.

902,499. INDUCTOR MAGNETO-ALTERNATOR. Leon Le Pontois, New Rochelle, N. Y., assignor to Hurd & Haggin. Filed October 24, 1907. A diamond-shaped field frame has the windings at the nearer corners, which have soft iron internal poles adjacent to a rotor.

902,513. ENDOSCOPE. Reinhold H. Wappler, New York, N. Y., assignor to Wappler Electric Controller Company, New York, N. Y. Filed January 11, 1908. An electric light bulb is screwed into the socket member.

902,522. ELECTRIC-CIRCUIT CONTROLLER FOR INTERNAL-COMBUSTION ENGINES. Charles Cuno, Oconomowoc, Wis., assignor to Connecticut Auto Engineering Corporation, Meriden, Conn. Filed September 19, 1906. A contact arm carried by the shaft engages an insulated contact block carried by the case.

REISSUES.

12,871. PROCESS OF TREATING NEGATIVE-POLE PLATES. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company. Filed January 14, 1908. Original No. 485,391, dated February 26, 1907. (Division A.) The process consists in soaking the plate in a solution of sugar, in depositing sugar in its pores and ultimately carbon, then drying the plate and heating it to carbonize the sugar and forming a final inert deposit of carbon.

12,872. NEGATIVE-POLE PLATE. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company. Filed January 14, 1908. Original No. 845,391, dated February 26, 1907, (Division B.) A Planté plate characterized by having inert material incorporated in the active material and a substantially sustained capacity in use.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 3, 1908:

462,231. ELECTRIC RAILWAY. E. M. Bentley, New York, N. Y.

462,237. ELECTRIC LIGHTING SYSTEM. J. I. Conklin, Brooklyn, N. Y.

462,261. AUTOMATIC ELECTRIC WELDING MACHINE. H. Lemp and C. G. Anderson, Lynn, Mass.

462,262. LAMINATED DIE, HAMMER, ETC., FOR ELECTRIC METAL-WORKING APPARATUS. H. Lemp, Lynn, Mass.

462,263. METHOD OF, AND APPARATUS FOR, CONSTRUCTING ELECTRIC-LIGHT OR OTHER LINES. H. Lemp, Lynn, Mass.

462,311. SYSTEM OF ELECTRIC LIGHTING. F. M. Garland, New Haven, Conn.

462,321 and 462,322. ELECTROMAGNETIC SEPARATOR. R. R. Moffat, New York, N. Y.

462,345. ELECTRIC SIGNALING SYSTEM. F. B. Wood, New York, N. Y.

462,348. GEARING FOR ELECTROMAGNETIC MOTORS. C. E. Chinnock, Brooklyn, N. Y.

462,353. ELECTRIC SWITCH. M. Hoopes, West Chester, Pa.

462,369. CONTROLLING DEVICE FOR ELECTRIC MOTORS. F. O. Blackwell, New York, N. Y.

462,407. ELECTRIC SWITCH. R. M. Hunter, Philadelphia, Pa.

462,418. METHOD OF, AND APPARATUS FOR, ELECTRICAL CONVERSION AND DISTRIBUTION. N. Tesla, New York, N. Y.

462,449. SECONDARY BATTERY. J. H. Palmer, Boston, Mass.

462,504. ELECTRIC CURRENT METER. J. T. W. Olan, New York.

462,513. AUTOMATIC SIGNAL APPARATUS. J. B. Stewart, Haverstraw, N. Y.

462,532. ELECTRIC COOKING STOVE. J. V. Capek, New York, N. Y.

462,540. INCANDESCENT ELECTRIC LAMP. T. A. Edison, Llewellyn Park, N. J.

462,578. TROLLEY FOR ELECTRIC CARS. R. D. Nuttall, Allegheny, Pa.

462,595. ELECTRIC RAILWAY. J. B. Sheldon and D. J. Murnane, St. Louis, Mo.

462,624. ELECTRIC ARC LAMP. T. Conroy, Kansas City, Mo.

462,672. CONDUIT ELECTRIC RAILWAY. A. J. Robertson, New York, N. Y.

462,673. ELECTRIC ARC LAMP. E. C. Russell, Boston, Mass.